PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

FOURTH SERIES

VOL. XXII, No. 11, pp. 221-271 SEPTEMBER 30, 1941

THE TEMPLETON CROCKER EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES, 1932

No. 40

THE GENUS SCALESIA*

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* Printed from the John W. Hendrie Publication Endowment.

INTRODUCTION

History and Materials

The genus *Scalesia* of the helianthoid *Compositæ* is the largest genus of vascular plants in the Galapagos Islands, and is one of the two genera of vascular plants which have been generally recognized as endemic, the other being the helianthoid genus *Lecocarpus* Descaine. *Scalesia* was described by Arnott from a specimen collected by Hugh Cuming in 1829,[1] and the description of the genus with its single species, *S. atractyloides*, was published by Lindley in 1836 (p. 443). The genus was referred to the *Heliantheæ Heliopsideæ*, that group in the classification of Lessing (1832, p. 223) containing a number of genera later referred by Bentham and Hooker f. to their subtribe *Verbesineæ;* but no definite statement of the relationship of *Scalesia* was made, although it might have been differentiated from other genera in that group by such characters as the homogamous heads and the compressed achenes without pappus. By De Candolle (1839, vol. 7, p. 308) the genus was placed among *genera incertæ sedis* and his description is derived entirely from that of Arnott. Two years later, Hooker and Arnott (1841, vol. 3, p. 312) published a description of the genus and remarked: "A very distinct genus unlike any with which we are acquainted." The position of *Scalesia* is fixed by Bentham and Hooker f. in the Genera Plantarum (1873, vol. 2, pp. 195, 367) in the subtribe *Verbesineæ* of the *Helianthoideæ* where *Scalesia* is placed between *Wulffia* Neck. and *Mirasolia* (Schultz Bip.) Benth. and Hook. f. From the latter, *Scalesia* is separated by the heads discoid or less amply radiate, by the involucres narrower, and by the achenes thinner (op. cit., p. 368), and from the former it is distinguished chiefly by the thinner achenes without frequently fleshy pericarp (op. cit., p. 195). Hoffmann (1894, p. 232) refers *Scalesia* to his *Heliantheæ-Verbesininæ*, but places it in a seemingly anomalous position between *Temnolepis* Baker, a monotypic genus of Madagascar, and the very natural North American genus *Rudbeckia* L., which, in turn, is followed by *Wulffia* and *Gymnolomia* HBK. The most recent generic description of *Scalesia* is that of Lemée (1934, p. 996), in which the older generic diagnoses are modified in the light of more recently described species; but no suggestion of relationship is given.

Most of the references to *Scalesia* in the literature of the past half century have related to reports on collections made in the Galapagos Islands. Of these collections, the two most important are those of Snodgrass and Heller, obtained on the Hopkins-Stanford Expedition

[1] This is the date generally accepted for Cuming's visit to the Galapagos Islands. The specimen of *Scalesia atractyloides* Arn. in Herb. Kew., however, bears a printed label with the date 1831, but undoubtedly this was not the year in which the specimen was collected but rather the year in which Cuming gave his collections to Sir William Jackson Hooker. (Cf. Howell, Hugh Cuming's Visit to the Galapagos Islands. In press.)

of 1898 and 1899, and of Stewart, obtained on the California Academy of Sciences Expedition of 1905 and 1906; and both were unusually rich in material of *Scalesia*. No fewer than five new species were described by Robinson from the former collection, and in the latter collection all the species then known from the islands were represented except two (and they are still known only from the type collections).

The present paper has grown out of an attempt to identify the specimens collected by the author as botanist on the Templeton Crocker Expedition of the California Academy of Sciences in 1932. Although the collections obtained in *Scalesia* are not comparable in number and diversity with those obtained by Snodgrass and Heller, or by Stewart, enough difficulty was encountered in attempting determinations to indicate the need of a revision of the genus with keys and diagnoses to the species. While in Europe in 1935, the author gave special attention to the genus, and the types of all the earlier species were examined at the Royal Herbarium, Kew, at the Herbarium of the University of Cambridge, and at the Herbarium of the Museum of Natural History in Stockholm. In the more immediate preparation of this paper, the collections of *Scalesia* in the Gray Herbarium of Harvard University, the Dudley Herbarium of Stanford University, and the Herbarium of the Brooklyn Botanic Garden have been borrowed; and these, together with the collections in the Herbarium of the California Academy of Sciences, have constituted as important and as adequate a working collection as may be had at the present time. From the treatment that has been prepared, it is hoped that not only will there result a better understanding of this remarkable genus taxonomically, but that also there will be suggested a solution of certain phyto-geographic problems to which it bears a definite relation.

Acknowledgments. For the assistance and many kindnesses given in the preparation of this revision, the writer wishes to express his appreciation and gratitude to his friends who have been helpful and to the officers and assistants of herbaria from which specimens have been borrowed, or at which they have been examined, particularly to Dr. T. A. Sprague at Kew, and to Dr. Eric Asplund at Stockholm. Dr. S. F. Blake, Washington, D. C., has answered questions of the writer, and, from his critical and extensive knowledge of the *Compositæ*, has offered helpful suggestions on several points. Miss Veronica Sexton, Assistant Librarian of the California Academy of Sciences, has given help in the bibliography, and Miss Ruth D. Sanderson, Librarian at the Gray Herbarium, copied and sent the original description of the genus. Library facilities at the University of California, generously extended to the author at all times, have been used for some works not in the Library of the Academy. The writer is grateful to Mr. Templeton Crocker for the opportunities offered on his expedition in 1932; and especially is he indebted to Miss Alice Eastwood, Curator of the Department of Botany of the

California Academy of Sciences, not only for the opportunity to study in Europe in 1935, but also for her help and sustained interest in the preparation of this work.

General Morphology

Habit. The species of *Scalesia* are all woody and erect, but in habit represent two distinct types, shrubs and trees. Although the shrubs are usually 1 to 2 m. tall, occasionally they are as low as 0.3 m., and, under favorable conditions, they may become arborescent and 3 or 4 m. tall. Usually the shrubs are rather openly few-branched from near the ground and do not present a "twiggy" appearance. The arboreous species may attain a height of 20 m. and are characterized by a single, well-developed trunk that is exceptionally clear of lower branches. At the upper and lower limits of the forest belt where the *Scalesia* trees are found, they may be considerably reduced in height and only 5 m. tall. Nothing is known of the roots of *Scalesia* aside from their perennial character.

Although the arboreous *S. pedunculata* Hook. f. is reminiscent of *Helianthus annuus* L. grown to fantastic proportions, the scalesias seem to represent growth forms that have lost all direct connection with herbaceous antecedents. In this particular, there is a distinct difference between the frutescent and arboreous members of *Scalesia* and the rosette-trees or megaphytes, as they have been called, which are found occasionally in other divisions of the *Compositæ*, in the *Lobeliaceæ*, and in other families of flowering plants. These remarkable plants, strikingly exemplified by the arborescent senecios and lobeliads of East Africa, and by the Silver Swords and lobeliads of Hawaii, appear to represent the exaggerated gigantism of herbaceous rosette forms, and not, as in *Scalesia*, an essentially frutescent and arboreous habit.

Stems. The stems are round and not striate, although the branchlets may be roughened by prominent scars left after the leaves fall. The trunk of *S. pedunculata* may become 2 to 3 dm. in diameter. The bark of shrubs and trees is smooth or wrinkled and not corky, and is brown or gray. The wood is soft, and even in the trees a pithy center is evident (Svenson, 1935, p. 215). A gummy or resinous sap seems to be common to all species in the genus, and is evident in specimens especially about flowering branchlets where a clear, amber-like bead will frequently form at broken places. Branching is subdichotomous or rarely truly dichotomous.

Trichomes. The vesture of the stems and leaves in *Scalesia* is varied in character, and has been described as sericeous, villous, hirsute, scabrous, subvelutinous, and glandular. The trichomes are essentially of two sorts, glandular and nonglandular. The glandular hairs may be capitate-glandular, or they may be slender, shorter or longer, viscidulous hairs. The nonglandular hairs may be stiff or

soft, appressed or spreading, dense or very sparse, short and conical or very elongate. In several of the species that are so markedly scabrous, the roughness is imparted chiefly by the hard, enlarged, conical bases of the nonglandular hairs, which persist after the slender elongate tips have broken off. No species of *Scalesia* is known to be entirely glabrous, and although most species are noticeably and distinctly pubescent, *S. Snodgrassii* Rob. is more nearly glabrous than any other. No species is known with only glandular hairs, but in some species glandular hairs are very few, if not entirely lacking. However, in some of those species which are without glandular hairs, the branchlets and leaves may appear to be glandular-viscid because of the resinous sap in them. The character of the trichomes, which in several entities impart a distinctive aspect that is reflected in the specific names (cf. *S. aspera* Ands. and *S. villosa* Stew.), is generally a reliable taxonomic character, and, together with other characters, may be used to advantage in separating species and varieties.

Leaves. When one considers the relative compactness of the genus *Scalesia* from the point of view of inflorescence and flowers, the diversity of leaf-form is exceptional, and exceeds even the great variability that is characteristic of some of the largest helianthoid genera on the mainland. Although the variation is so very great when the genus is taken as a whole, several distinct leaf-types are discernible, and in this work they have been used as the chief criteria to limit four series of species. In general shape the leaves vary from nearly linear to suborbicular, and from entire to deeply bi- or tri-pinnatifid. In general the leaves are distinctly petiolate, occasionally subsessile. Usually the blades are rather prominently 3-nerved from the base, but in those species with lobed leaves, the blades are pinnately veined. In the triplinerved leaves, the lowest pair of veins may be more or less confluent with the upper, lateral veins or they may form a pair of definite, submarginal nerves that extend to the apex. The former is more characteristic of wider leaves, the latter of narrower leaves. The apex of the blade is usually acute, though sometimes it may be obtuse or acuminate; the base of the blade is cordate, truncate or cuneate. Sometimes the base is decurrent and the petiole is bordered for a longer or shorter distance or even to the base.

The bordered or "winged" petiole should here receive some special attention. Heretofore the presence or absence of a border has been used as a taxonomic character to which some importance has been attached; and, in recognition of it, Andersson even adopted the epithet *decurrens* for one of his species. In this work the development of a wing on the petiole, striking as it generally is, has not been regarded as a reliable taxonomic character, and has not been given even varietal value. In *S. gummifera* Hook. f., leaves on vigorous shoots have been seen with petioles narrowly bordered to the base, while on less vigorous branchlets the petioles were entirely un-

winged; in *S. Crockeri* Howell, the leaves produced during the exceptionally favorable season of 1932, when they were collected, had broad wings which at the base were auriculate-enlarged, but on the same shoot were withered leaves of an earlier season with petioles unwinged. In the narrower leaves, the base of the blade is so gradually attenuate into the wing that it is scarcely possible to determine where the blade ends and the petiole begins, and those leaves termed "subsessile" in diagnoses belong to this type (cf. *S. villosa* Stew.); but in leaves with broader blades the petiole is usually very definite, no matter how broad the wing. This sort of variation occurs in many helianthoid genera, but it is doubtful if elsewhere the wings can be so conspicuous a feature and so untrustworthy taxonomically as they are in *Scalesia*. Blake (1918, p. 23) has already discussed the morphology and venation of this type of leaf in his monograph of *Viguiera*, and what he writes there is equally applicable to *Scalesia*.

In texture there is some variation in the leaves of *Scalesia*, but not as much as might be expected in a genus whose species range from extreme desert conditions of a practically unweathered lava-flow to the heart of a dense, tropical rain-forest. In all species the leaves are well-developed. In vesture, however, there is great variation, and, while generally its character is relatively constant for a species, there are several exceptions which will be discussed in the taxonomic section later.

In *Scalesia*, variation in phyllotaxy is also anomalous. By both Bentham and Hooker f. (1873, p. 367) and by Hoffmann (1894, p. 232), the alternate arrangement of the leaves was emphasized as a character of generic importance; but with increased collections, what was once considered so important a character is now not regarded of even varietal value, unless supported by other differences. While generally arranged alternately, one or two species, as they are now known, have leaves opposite (cf. *S. Helleri* Rob.). In many species with leaves usually alternate, an occasional pair of leaves may occur which appear to be opposite, but are not truly so. Sometimes such pairs seem to develop after the close of the rainy season when the growth of the plant is retarded, and a fore-shortening of internodes results in a falsely opposite relation; but occasionally on shoots with all or most other leaves alternately arranged, pairs have been seen that are indubitably opposite.

Inflorescence. The heads are usually 1 or 2, or rarely 3 or 4, at the ends of the branchlets, and, although they arise from the axils of the uppermost leaves, the shoot which bears them usually terminates with them, and one or more branches arise from axils immediately below them. The peduncles are usually naked, rarely with one or two leafy bracts, and vary from very short or almost none in *S. Darwinii* Hook. f., to as much as 15 cm. long in *S. pedunculata* Hook. f. The relative length of leaves and peduncles has been emphasized in the past, and is still a character that is useful

in certain instances when correlated with other characters. In *S. microcephala* Rob., and probably also in the closely related *S. cordata* Stew., the heads are several, and are arranged in a short, corymbose, leafy cluster, the only approach to an aggregate arrangement of heads known in the genus. The heads are usually medium-sized and 1 to 3 cm. broad, but in *S. microcephala* they are sometimes only 0.5 cm. broad.

Involucre. Except for those species in the series *Foliaceæ*, the character of the involucre and phyllaries has not exhibited distinctive variations which could be used to much advantage taxonomically, except in certain species when correlated with other characters. This relative uniformity in the essential character of the involucre, and a corresponding uniformity in flowers and fruits has led to the conclusion that *Scalesia* is a genus in which fundamentally divergent tendencies are lacking. In general shape, the involucre varies from tubular-campanulate to broadly hemispheric-campanulate. The sides are straight or in some species are constricted, especially in fruit, above a somewhat swollen base. The phyllaries are usually loosely to closely imbricate in 2 to 4 series, and vary from narrowly oblong to nearly orbicular in shape. In most species the phyllaries equal or are a little shorter than the disk, but in the series *Foliaceæ* the outer phyllaries are foliaceous and longer than the disk. In age the phyllaries are usually indurate, at least at the base, and somewhat veined. The vesture of the phyllaries does not differ essentially in character from that of the leaves and stems.

Receptacle and Pales. The receptacle is flat or low-convex, and nearly smooth. The pales are sharply folded or carinate, and closely envelop the flowers before anthesis, and the fruit at maturity. At the top, the pales are trifid or shallowly 3-lobed, and the variation in the shape and size of the lobes has proved a useful character in the separation of closely related varieties or species. Sometimes the lobes are about equal in length and width, sometimes the lateral lobes are shorter and narrower than the middle lobe; generally the lobes are triangular-deltoid, and acute or acuminate, but in some species they are more or less widened upward, and are obtuse or emarginate. The margin of the pales varies from entire and glabrous to ciliate or irregularly laciniate-cleft. The lobes of the outermost pales frequently differ more or less in shape from those in the inner part of the head, which are the ones described in the diagnoses. Whether the pales are persistent or deciduous is not known for many species because of the paucity of material, but it is probable that they are persistent, and fall only as the heads disintegrate.

Corollas. In *Scalesia* the flowers are either neutral, ligulate ray-flowers or fertile, tubular disk-flowers. The corollas of both kinds are white. The rays are few in a single series, and occur in two, closely related species, *S. gummifera* Hook. f. and *S. affinis* Hook. f.

The ligules are several-nerved and rather irregularly 2- or 3-dentate at the apex. The disk-corollas are tubular with a 5-toothed limb. The throat is somewhat ampliate, and is generally longer than, and well-differentiated from, the more slender tube. The disk-corollas are straight and erect in the head, or frequently they are outwardly curving. In four species of the series *Lobatæ*, an interesting modification of the corollas of some of the marginal flowers is an enlargement and ligule-like development of the limb. Although such flowers seem to be sterile with styles and stamens abortive or lacking, the various shapes assumed by the corolla-limb has led me to interpret these flowers as modifications of disk-flowers. Sometimes the limb is more or less oblique, with the limb palmately expanded on the outer side, at other times the enlarged corolla is somewhat bilabiate, and yet again it may be lobed with a separate distinct lobe opposite the expanded, ligule-like part. This structure is not conspicuous, which may account for the fact that it has not been noted heretofore. These corollas are only 5 to 7 mm. long, and are strongly recurved.

There is a little variation in the character and distribution of pubescence on the outside of the corollas, but the differences are slight and not of taxonomic importance. Usually the lower sides of the lobes bear a few, stoutish trichomes and the tube is more or less hairy. Occasionally the nerves of the throat are pubescent, and rarely the tube is glabrous.

Andrœcium and Gynœcium. The characters of the stamens and pistils do not differ from those in related genera: the appendage of the anthers is broadly lanceolate to ovate, and the bases are cordate or sagittate; the style-branches vary in length in different species, but, in all, the triangular-acute or more elongate appendage is papillose. The anthers are purple.

Achenes and Pappus. The strongly flattened achenes of the genus *Scalesia* appear to represent the chief character to which generic importance can be attached and by which *Scalesia* may be most definitely separated from its relatives. The pericarp is not thickened, the sides are smooth or occasionally bear a low longitudinal rib, and the edges are not at all winged. The achenes are oblongish, slightly widened upward, rounded at base and sub-truncate above, and glabrous. Usually there is no pappus, but in some species two, short, slender, smooth bristles are borne at either end of the truncate top. Sometimes when no bristles are present, pappus is represented by two callous spots or stubby processes of horny texture.

Generic Status and Relationship

Although Hooker and Arnott wrote of *Scalesia* as a very distinct genus (1841, p. 312), no such opinion has been expressed since Bentham and Hooker f. in the Genera Plantarum aligned the nearly related genera of the *Verbesineæ* so that their close interrelation is readily apparent. Of these numerous genera, "the great majority of them American", Bentham in his masterly paper on the *Compositæ* has written as follows: ". . .many of them natural enough, but distinguished by characters of comparatively small importance, sometimes passing into each other, and often very technical and very difficult to group together except into very artificial series. . ." (1873, p. 439). At several places in the same paper Bentham remarks on the interrelation of *Scalesia* and other Galapagian *Compositæ* with the *Compositæ* of the Mexican and Central American region of North America. "In the insular genus *Scalesia*, eighteen or ten Galapagian species, may be traced a connexion with . . . *Mirasolia*, which belongs to the southern or Central American portion of the Mexican region" (p. 444); and, again: the "affinity" of the Galapagian *Compositæ* "seems to be rather with those of Central America than of the more immediately opposite coast of Ecuador" (p. 556). In "Table 14. Compositæ of the Galapagos Islands", Bentham writes opposite *Scalesia* under the heading "Connexions", "*Mirasolia* and other Central American Wedelioid Helianthoideæ" (p. 556); and on the following page (p. 557) goes so far as to say of the two endemic Galapagian genera he recognizes: "*Lecocarpus* and *Scalesia* might without difficulty have been referred to *Melampodium* and *Mirasolia* respectively as sections. . . ."

Hoffmann and Robinson have also expressed opinions relative to *Scalesia* and related genera, but only reiterate what Bentham wrote. Hoffmann, after describing the subtribe *Helianthea-Verbesininæ*, echoes Bentham's remarks of two decades earlier when he says, ". . .deren Gattungen zum Teil schwierig und nur durch künstliche Merkmale zu unterscheiden sind" (1894, p. 226). Robinson, in his analysis of the Galapagian flora, writes that "even *Scalesia* is not a strong genus, as it is not easy to show very sharp, generic distinctions between it and some allied *Helianthoideæ* in Mexico and Central America" (1902, p. 242); and later he writes of the "Mexican allies" of *Scalesia* (p. 255). James Small (1919) in his studies on the *Compositæ* says nothing pertinent to this aspect of our problem.

From this historical review, two questions emerge requiring at least consideration, if not tentative answers: (1), should *Scalesia* be maintained as a genus; and, (2), if it is so recognized, what appears to be its probable relationship to other helianthoid *Compositæ*.

Because of Bentham's repeated references to *Mirasolia* as a near relative of *Scalesia*, a brief history of that genus is appropriate in a consideration of both these questions. *Mirasolia* was first described as a subgenus of *Tithonia* by Schultz Bipontinus in Seemann's

Botany of the Voyage of the Herald (305,—1856–7), where it was distinguished by its glabrous, epappose achenes; and was later raised to generic rank by Bentham and Hooker f. in Genera Plantarum (1873, pp. 367, 368), where it was related not only to *Scalesia* but to *Tithonia*, *Wulffia*, and *Balsamorhiza*. Hoffmann (1894, p. 235) returns *Mirasolia* to *Tithonia*, and Blake (1921, p. 424), in his revision of the genus *Tithonia*, treats it likewise. While there is no apparent similarity in habital appearance between the usual, cultivated *Tithonia*, *T. rotundifolia* (Mill.) Blake, and *Scalesia*, the dissimilarity between our genus and those species of *Tithonia* formerly referred to *Mirasolia*, especially *T. scaberrima* Benth., is reduced to a more technical consideration. However, *Tithonia*, as now accepted and including *Mirasolia*, with its convex receptacle, usually aristate-acuminate pales, and strongly thickened or subquadrangular achenes, does not seem to represent a generic concept so near to that of *Scalesia* as to those of *Helianthus* and *Viguiera* (cf. Blake, 1918, p. 21), and to the same immediate relationship *Balsamorhiza* should also be referred (cf. Sharp, 1935, p. 57). *Gymnolomia*, which is grouped with *Scalesia* by Hoffmann (1894, pp. 228, 233), has now been reduced to a few Andean species related to *Aspilia* (cf. Blake, 1918, p. 13), and the North American elements, some of which were treated at one time under the generic designation *Heliomeris* Nutt., have been referred to *Viguiera* or related genera by Blake (1918, pp. 13–21).

So disposing of these genera as more particularly a part of the *Helianthus* group of genera, only the genus *Wulffia* remains of those mentioned by Bentham in connection with *Scalesia*. Here, it would seem, the relationship to *Scalesia* is much more definite. In Bentham and Hooker f., *Wulffia* immediately precedes *Scalesia*, and by Hoffmann it is only once removed from *Scalesia* in the generic sequence. It is a genus with only two species, one of which, *W. baccata* (L. f.) O. Ktze., is widely distributed from the West Indies to subtropical South America. Following O. E. Schulz (1911, p. 91), *Wulffia* may be characterized by its woody, scandent habit, convex receptacle, yellow-flowered heads with sterile rays, acute or acuminate pales, and more or less quadrangular achenes, which become tumid and succulent ("*denique tumida et succulenta*"). From this it is apparent that for *Scalesia* such important characters as the trifid pales and the strongly flattened, thinly coated achenes remain for differences of a generic order, differences that are supported by such valuable secondary characters as frutescent and arboreous habit, usually alternate leaves, white flowers, and plane or low-convex receptacle. So it would appear that *Scalesia* is sufficiently removed from *Wulffia* and its cotribuals to be maintained as an insular genus and as such it is here accepted. In theoretical support of our acceptance of *Scalesia*, these lines from Robinson's address on the generic concept in the classification of the flowering plants are apropos: " . . . few, if any, genera carry conviction as natural groups, or, to be more

precise, naturally delimitable groups, unless they can be separated by more than one feature. The ideal genus is certainly one in which several distinguishing traits are constantly associated. When limits are properly drawn it is certainly true that a very large number of such ideal genera exist. Unfortunately for the peace of mind of the systematist, however, there are considerable series of species in certain families, which quite defy classification into genera of this sort. They are groups in which we are forced into accepting a far less satisfactory type of generic division, and in some cases it is necessary to make the most of a single character . . . " (1906, p. 87).

While it does seem likely that *Scalesia* finds in *Wulffia* a closely related genus, it is highly improbable that the relatively unvarying climber *Wulffia* gave rise to the highly diverse and variable series of shrubby and arborescent species in *Scalesia*, or *vice versa*. Rather it would seem that these two genera, and probably others about as nearly related, have had a common antecedent, and that subsequent generic differentiation has developed along lines more or less collateral and parallel. The ancient type might well have resembled the present-day group of genera which center in *Wedelia* and *Aspilia*, a group marked by characters which are variable in themselves and from which might easily have been derived such technical differences in heads, flowers, and fruits as are used to distinguish *Scalesia*, *Wulffia*, and related genera. This group is both herbaceous and woody, leaves are both alternate and opposite, pales are entire, ray-flowers are both fertile and sterile, and the thickened achenes usually have well-developed pappus. Moreover, it is wide-spread and occurs both in South America and Africa (which fact will help explain the immediate proximity of the Madagascarene *Temnolepis* to the Galapagian *Scalesia* in the generic sequence of Hoffmann).

The probability of *Scalesia* and *Wulffia* belonging to the *Wedelia-Aspilia* group of genera had made a strong appeal to me even before I knew that Bentham had expressed similar ideas. At several points in his treatise on the *Compositæ*, Bentham refers to this wedelioid complex and the relation of *Wulffia* and of *Scalesia* to it. Thus, as has already been quoted, in his table on the *Compositæ* of the Galapagos Islands, he gives the relations of *Scalesia* as "*Mirasolia* and other Central American wedelioid Helianthoideæ" (1873, p. 556), and before that, "the tropical *Wulffia* . . . and the tropical and Mexican *Perymenium* . . . have their nearest connections probably with *Wedelia* and with *Melanthera*" (p. 445). So it would seem that *Scalesia*, *Wulffia*, and a half dozen or more genera that are about equally interrelated may be definitely related to *Wedelia* and *Aspilia*, and that all together they may have been derived from an ancient African or South American wedelioid prototype. And, if it is too much to imagine that close connection between South America and Africa which present-day distribution suggests, a connection broken eons ago either by the sinking of a long-lost Atlantis or by the rifting and drifting of continents, a convenient center of

dispersal may, with much reason, be located on a warm Antarctica of the preglacial Tertiary (cf. Scharff, 1912; Wegener, 1915; Skottsberg, 1925; Chubb, 1933).

Whether these wedelioid genera should be combined into a large, all-inclusive genus as sections or subgenera is not a question to consider here. Such a course has been pursued in certain asteroid groups, and most floristic botanists are now following where the synantherologists have led; but even there, as here, it seems as if the nicer and finer generic distinctions are more useful in discussions of relationships and matters of geographic distribution. As Blake (1918, p. 14) has written in his monograph of *Viguiera:* "The aim of generic limitations however is not merely to provide an easy index to our real units the species, but to indicate their true genetic relationships so far as this can be done without too great a sacrifice of clearness and precision." And finally, as Bentham has so ably and concisely put it in discussing the smaller helianthoid genera of the Mexican region (*Rumfordia, Selloa, Axiniphyllum, Varilla, etc.*): "Small as they are, I do not think that any of these genera are sufficiently connected with any of their large cotribuals to be incorporated with them, unless these again be much more consolidated; nor do they form of themselves a separate group in the subtribe. Like so many others of the same region, they may be considered as the scattered remnants of various ancient races . . . " (1873, p. 444).

Generic Subdivisions

It was early apparent in my study that the species in *Scalesia* align themselves in four groups, and almost from the beginning I have found it convenient to treat these groups as taxonomic subdivisions of the genus. It has been decided to designate them as series, for, although they are usually quite distinct from one another, they are not based on characters to which subgeneric importance can be properly attached. The great differences in the shapes of the leaves, which is one of the remarkable features of the genus, afford the chief basis for the classification, and with the variation of leaf-shape can be correlated distinctive venation patterns. In one series the foliaceous enlargement and elongation of the outer phyllaries offer an additional criterion, which has proved a very natural and convenient distinction.

The series have been designated as *Lobatæ* (with seven species), *Dentatæ* (five species), *Pedunculatæ* (three species), and *Foliaceæ* (three species). In the *Lobatæ* the leaves are shallowly to deeply lobed, or even bi- or tri-pinnatifid, and the lateral veins end in a lobe on the margin. In all the other series the lowest pair of lateral veins extend strongly forward toward the end of the leaf where they are either confluent with other lateral veins, as in the *Dentatæ* and the *Pedunculatæ*, or form a pair of distinct marginal nerves as in the

Foliaceæ. In the *Dentatæ* the leaves usually have a conspicuously toothed margin, and, in the *Foliaceæ* and *Pedunculatæ*, in which the leaf-margins are entire or nearly so, elongate, foliaceous phyllaries distinguish the *Foliaceæ* from the *Pedunculatæ*.

Two further matters relating to the series should be briefly discussed, the distribution of these species-groups in the archipelago, and their relative age. The series *Lobatæ* with the largest number of species is also represented on the greatest number of islands, seven species on six islands, Chatham, Barrington, Indefatigable, Duncan, Abingdon, and Wenman islands. These islands, except Duncan, are roughly aligned southeast to northwest along the northeastern side of the archipelago, and it would appear probable that the dispersal of the species in the series has taken place along the line of the Southeast Trade Winds. Support to this theory of dispersal comes from the fact that *S. divisa* Ands. on Chatham Island, the southeasternmost island in this alignment, is the least differentiated species in the series, and resembles more closely certain species in the *Dentatæ* and *Pedunculatæ*, the series which are regarded as primitive, as will be pointed out later. Aside from *S. divisa* and *S. Helleri* Rob., the latter a very distinct species on Barrington Island and adjacent Indefatigable, the other species of the series are very closely related, and seem to represent variants isolated on different islands.

In the *Dentatæ*, with five species on five islands, Charles, Albemarle, Narborough, Indefatigable, and North Seymour islands, a similar tendency towards a southeast-northwest alignment is to be noted extending from Charles Island to Albermarle and Narborough islands, while Indefatigable and adjacent Seymour lie a little outside the alignment to the north. In the Galapagian species of the genus *Mollugo* a comparable evolutionary trend has been noted (Howell, 1934a). The *Pedunculatæ*, represented by three species on the five, large south-central islands (Chatham, Charles, Indefatigable, James, and Albermarle islands), do not seem to be aligned as do the *Lobatæ* and the *Dentatæ*, but rather to be encompassed by an arc whose center is Chatham Island. However, a possible evolutionary sequence may be correlated with a southeast-northwest geographic distribution in the *Pedunculatæ* if a plant resembling *S. pedunculata* var. *parviflora* Howell on Charles Island were the progenitor of *S. cordata* Stew. in southern Albermarle Island; and if *S. microcephala* Rob. of central and northern Albemarle were derived from *S. cordata*. The *Foliaceæ* is not only the most compact of the series, but is known only from James Island.

The selection of the primitive form in the series *Lobatæ* from Chatham Island, and the suggestion of evolutionary alignments in the *Dentatæ* and *Pedunculatæ* centering in Charles Island, may be interestingly correlated with the theory that, geologically considered, the islands of Chatham, Hood, and Charles are the oldest (Chubb, 1933, p. 21).

Bindloe and Hood islands are the only two of the larger islands on which no *Scalesia* has been found; and, although Hood Island has been rather well explored and problably has no *Scalesia* on it, we may expect the discovery of a species of the *Lobatæ* on the relatively little-visited Bindloe if my theory of dispersal in that series is correct.

As to the relative age of the series in *Scalesia*, not much is to be said. In a group as generically compact as *Scalesia*, it is not easy to indicate primitive and advanced species, and especially is this so in a genus in which so many species are highly specialized for a particular environment. Of only one series, the *Foliaceæ*, can it be said that it probably is of relatively recent origin, both because of its narrow distribution, and because of the derived relation it seems to bear to *S. affinis* Hook. f. In each of the other series are species which may seem to be advanced in certain characters, but primitive in others. Thus, if radiate heads are primitive, *S. gummifera* Hook. f. and *S. affinis* of the *Dentatæ* would form the base of an evolutionary tree, but in their adaptation to a most rigorous environment, they are among the most highly specialized. The arboreous habit in the *Pedunculatæ* may be counted as primitive, but the heads are discoid; and a pair of similar species in the *Lobatæ* and *Dentatæ*, *S. aspera* Ands. and *S. divisa* Ands., perhaps indicates a close, primitive relation between those series. However, along with the *Foliaceæ*, the *Lobatæ* (except for *S. divisa*) can probably be regarded as a derived group of relatively recent origin, chiefly because of the venation of the much-cut leaves, which is a distinct departure from the usual helianthoid, triplinerved type. But whether one of the several groups in the discoid and radiate *Dentatæ*, or in the *Pedunculatæ* can be chosen as primitive is doubtful. Rather it would seem that these groups are closely interrelated, and that the truly primitive type from which they have been derived has been obliterated in the process of adaptation or selection of variants for specialized surroundings.

Relative to the development of a shrubby or arboreous habit in the *Compositæ* as an indication of age, it is of interest, but perhaps not of much moment, to quote James Small: "The shrubs peculiar to so many oceanic islands are probably . . . the result of the direct action of aridity, wet and cold, or hot and dry conditions. . . . The large shrubs and trees are obviously the extreme development of the shrubby condition. These trees usually occur as more or less isolated specimens high up on the mountain sides where there are open associations and consequently very little competition, and where all the ecological conditions tend to slow growth and lignification. The trees of the oceanic islands have long been objects of interest, usually regarded as relics of an ancient flora, but in the light of the new views on the origin and dispersal of species they are to be considered as more or less recent species which have become arborescent under the influence of external conditions. . . " (1919, p. 22).

In *Scalesia*, the three-nerved leaves, the radiate heads of species in the *Dentatæ*, and the arboreous habit in the *Pedunculatæ* should undoubtedly be regarded as primitive characters.

Species Concept

In this revision some species have been given a more conservative treatment than others, and to me the inconsistency seems especially apparent; but in those cases where a less conservative treatment has been followed, material is so scanty that it has seemed insufficient on which to propose fewer and more conservative entities. Sometimes, as in the cases of *S. incisa* Hook. f. and *S. retroflexa* Hemsl., the species are known only from a single collection. In other cases, as in *S. Hopkinsii* Rob., where two or three collections have been made, just enough material has been obtained to indicate certain tendencies in variation, which, with the collection of more material, may appreciably alter specific limits as I have accepted them. Though not entirely satisfied with such species, I believe there is not the least justification for attempting to change the specific limits at present.

In contrast to these species are several which are more conservatively treated, and, because there is now available a number of collections of each, I have felt it proper to realign specific limits in the light of variations and inter-gradations disclosed. These species are *S. pedunculata* Hook. f., *S. gummifera* Hook. f., and *S. affinis* Hook. f., and to each has been reduced a variant which heretofore has received specific recognition.

Besides these larger and more variable species, there are a few which seem remarkable for their distinctness and consistency, and, although they are known mostly from only a few collections each, they are believed to represent fixed types which will not merge with related species. The closely related but distinct species in the series *Foliaceæ* belong to this group, and *S. Helleri* Rob. of the *Lobatæ*, and *S. villosa* Stew. of the *Dentatæ* are others. With the collection of further material, it seems likely that named varieties of several species will be recognized; and, since *Scalesia* is part of an insular flora in which many species are highly localized, and is itself remarkable for distinct local species, the discovery of new species in the genus is to be expected as the islands are intensively explored.

Ecological Distribution

Species of *Scalesia* are found from the hottest and driest lava deserts of the lowlands to the cooler and damper forest belt in middle altitudes of the higher islands, or to brushy slopes above the forests. Such species as *S. gummifera* Hook. f., *S. affinis* Hook. f., and *S. Stewartii* Riley growing on lava flows which still look as

fresh and unaltered as the day when they cooled, are especially remarkable. On Albermarle Island at Tagus Cove *S. gummifera* and *Cereus Thouarsii* Weber are pioneers on the barren wastes. Such species remain even after other hardy species have become established and form a sparse scattered growth on the lava, but the *Scalesia* is not known to persist in any brush formations which develop as the lava disintegrates. Other species of *Scalesia*, such as *S. villosa* Stew., and *S. Crockeri* Howell near sea level, and, at higher elevations *S. microcephala* Rob., are found in this later succession of plants. Unfortunately no collections in the series *Lobatæ* were made by the author, but from field notes on Stewart's collections it is believed that most of the species of that series belong to this group of species that grow with other shrubby plants on partly disintegrated lava. The arboreous species of the series *Pedunculatæ* are the only ones known to grow in deep soil, such as is found in the rain-forest belt.

In his account of "botanical conditions on the Galapagos Islands," Stewart (1915) describes the field occurrence of many of the species of *Scalesia* on the different islands, and references to his account are given under the different species in the taxonomic section of this work.

The distribution of the species of *Scalesia* among the different islands is highly characteristic of the distribution of other variable groups on the Galapagos Islands. In this group, as in others, the geographic isolation afforded by the different islands has not only allowed the segregation of ecologic and morphologic variants, but has also been effective in perpetuating them. In *Scalesia* these segregates are sometimes regarded as specifically distinct, as in the series *Lobatæ*, or at other times they are interpreted as varieties of a variable species, as in *S. pedunculata* Hook. f.

Because of the diverse edaphic and climatic conditions on the Galapagos Islands, which vary from barren lava-deserts to rain-forests of almost tropical luxuriance, an ecological segregation has also taken place in *Scalesia* and other variable phanerogams of the islands, a type of segregation that affords an isolation no less real than the truly insular type. By this type of segregation, which has been recently discussed in detail by Turrill (1938), a species of *Scalesia* which has become adapted to a highly specialized environment on unaltered lava is confined as definitely to fresh flows as if it were on an island surrounded by water, and to such a species, a forest belt or a patch of brush on disintegrated lava may be as impassable a barrier as a mountain range. Undoubtedly this sort of segregation has been an important factor in the development of the three species in the series *Foliaceæ* that are found on James Island; first of all in the original divergence of the prototype of the series from *S. affinis* Hook. f., and later in the segregation of the three species within a few miles of each other.

Not uncommonly the same ecologic factors effecting segregation

are locally active in several, unrelated groups of plants, and, because of the peculiar geologic history or critical geographic position of the particular district where they grow, an endemic area may emerge in which unrelated entities exhibit parallel responses to some specialized, ecologic condition. Such an area seems to occur in the vicinity of Sulivan Bay on James Island, where several remarkable and distinct species are found, such as *Philoxerus rigidus* (Rob. & Greenm.) Howell, *Mollugo Crockeri* Howell, *Coldenia nesiotica* Howell,[2] and *Scalesia Stewartii* Riley; and another is that region including the Seymour islands and adjacent Indefatigable, where such local species as *Paspalum redundans* Chase, *Alternanthera Snodgrassii* (Rob.) Howell, *Bursera malacophylla* Rob., *Euphorbia bisulcata* Howell, *Opuntia Zacana* Howell, and *Scalesia Crockeri* Howell are found.

It has seemed worthwhile to call attention to these aspects of our study, although such ecologic studies as these properly require a great amount of detailed information which is practically lacking for the Galapagos Islands. This branch of botanical research, however, is most important, and valuable data are likely to be obtained in the Galapagos Islands, which have been called "Evolution's workshop and showcase" (Howell, 1934b, p. 515), and which embrace so large an area but little affected by man. For as Turrill (1938, p. 390) remarks at the close of his paper on "Ecological Isolation", ". . . it is highly desirable that it (*i. e.*, ecological isolation) should be intensively studied in wild floras (and faunas) before man's interference is carried so far that natural vegetation becomes only a paleobotanical phenomenon."

Scalesia and the Origin of the Galapagos Islands

The origin of the Galapagos Islands, whether they are oceanic or continental, has been considered in relation to these distributional matters in the genus *Scalesia.* Georg Baur (1891) used the term "harmonic" to designate the relation he found between varieties and species in certain groups of plants and animals on the different islands, a condition which to him indicated a former continental connection followed by gradual subsidence. Baur, however, applied the term in a strictly internal sense from the harmonic biologic relations among the several islands, and drew his conclusions only from this *internal* consideration. What he should have endeavored to show also was whether the fauna and flora of the islands were "harmonic" or "disharmonic" with the fauna and flora of the continental mainland, a much more difficult problem requiring extended knowledge of the continental biota. Certainly *Scalesia*, with the distribution of nearly related species on the different islands, is

[2] **Coldenia nesiotica** Howell, nom. nov. *Coldenia conspicua* Howell, Proc. Calif. Acad. Sci., (4), **22**: 105 (1937), not *C. conspicua* Johnston, Journ. Arn. Arbor. **16**: 183 (1935).

to be regarded as harmonic from a strictly insular or internal point of view, as the term has been used by Baur. From a broader or external point of view, the relation between *Scalesia* and the helianthoid *Compositæ* of both North and South America can also be regarded as harmonic; for, although the genus is strictly insular and therefore may be interpreted by some as a distinct break with mainland relatives, in reality it bears the same relation to genera on the mainland as they bear to one another. With time, however, the disharmonic character of the faunas and floras of oceanic islands becomes concealed or blurred as new insular forms evolve, and, on the other hand, the fauna and flora of a continental island might become disharmonic due to the extinction of numerous species, genera, and even families (Gulick, 1932, pp. 418, 423).

In the present study of the genus *Scalesia* no new data have been disclosed on the origin of the Galapagos Islands, but there is nothing that has been learned which would conflict with a theory that formerly there was a connection between an emerged region, where the islands now are, and a continental mass to the northward or eastward. On the other hand, there is perhaps nothing to conflict with the theory that in the beginning the genus was accidentally introduced by wind, birds, or float from the mainland on a Galapagian island of oceanic origin. But to me it seems that the *probability* of the arrival of the genus by a land connection is greater than the *probability* of successful transportation across a broad expanse of ocean. The fruits are not susceptible of wind transportation, and the thinness of their pericarp would not preserve them from ocean water on a long journey on driftwood, nor from digestive juices during the flight of a bird. The physiological difficulties attendant on the establishment of a fruit, even if it were to arrive, also seem insurmountable when the peculiarities of growth requirements are considered. That the progenitor of our present species may not have been so highly specialized is, of course, a fact to be reckoned with; but a presumption of this sort is perhaps more highly theoretical than the presumption that there was once a large land mass with continental connections where now the Galapagos Islands lie. My experience with the distribution of plants in continental areas, such as California and the Great Basin, where endemism of a marked insular character is very common, is perhaps a chief reason why I place so low value on the probability of "accidental" transportation. So, although I cannot positively say that data from my study of *Scalesia* point to a former continental connection, the indication from both morphological and physiological considerations seems to be definitely in that direction.[3]

[3] The alignment of evolutionary trends in several of the series within the archipelago along lines parallel with the direction of the Southeast Trade Winds, a phenomenon that has been briefly described in the discussion of the series, does not offer the same degree of difficulty in matters of dispersal that is presented by an expanse of ocean hundreds of miles in extent. Moreover, the distribution of *Scalesia* through the Galapagian area may have been accomplished at a time when the islands were even less distantly separated than now, or when only a single, inclusive Galapagian land existed.

This theory which I favor finds further support, albeit weaker than I would like, in maps like those of Scharff (1912, figs. 14-17), which indicate the hypothetical distribution of land and water during the Tertiary, and which show the Galapagian area connected either with Mexican, Central American, or South American regions. Much more plausible and definite evidence for a former land connection with the Central American region comes from the study of submarine topography and the existence of the so-called Galapagos Plateau, which, when it is bounded by the 1500 fathom line, is shown as a circular, equatorial area with a broad, northeastern extension that encompasses Cocos Island and approaches very closely the coast of Panama southwest of Mariato Point. (See charts in Mem. Mus. Comp. Zool. Harv. College, vol. 24, pl. 85, and Bull. Mus. Comp. Zool. Harv. College vol. 23, no. 1, pl. 3). While an orogenic disturbance of much less magnitude than that which resulted in the Andean cordilleras would make dry land of this submarine plateau, there is no lack of evidence, biological, geological, and geographical, that the Panamanian region and adjacent seas have had a varied history in the Tertiary (cf. Dickerson, 1917, p. 205; Dacqué, 1915, map). And perhaps to be correlated with these continental disturbances is the evidence to be found in different parts of the Galapagos Islands that they have been subjected to elevations and depressions, and that at least local, diastrophic movements have taken place (Dall and Ochsner, 1928; Howell, 1932; Chubb, 1933; Hertlein and Strong, 1939). This probable paleo-geographical relation between the Galapagos Islands and Central America finds still further support in the fact that the lava of the islands is predominantly basaltic, which is the North American lava-type, and not andesitic, the South American type (Pilsbry, 1930, p. 121; Richardson, 1933, p. 64; Hertlein and Strong, 1939, p. 368).

Present geological evidence is perhaps still insufficient for a definite authoritative statement regarding the origin of the Galapagos Islands, but it would appear that from insular studies in the several branches of geology will eventually come the answer that can only be theoretically approached in botany and zoology.

SYSTEMATIC TREATMENT

Scalesia Arnott

Heads homogamous and discoid, or rarely heterogamous with few neutral ray-flowers. Involucres narrowly to broadly campanulate, the phyllaries closely or loosely imbricated in 2 to 4 series, narrowly oblong to round-ovate, the innermost plane, the outer coriaceous-thickened, becoming more or less indurate in age, occasionally with herbaceous foliaceous tips. Receptacle plane or low-convex, the pales trifid at apex and folded or carinate along the middle, enclosing the disk-flowers, probably persistent. Corollas of the ray-flowers rather short, several-nerved and irregularly 2- or 3-toothed at apex; corollas of the disk-flowers tubular-funnelform with a 5-toothed limb, or occasionally the outermost oblique and radiate-enlarged. Anthers cordate at base, not caudate, the apical appendage lanceolate to ovate. Style-branches straight or coiled, the papillose appendage triangular and acute or more elongate. Achenes of ray-flowers sterile, achenes of disk-flowers fertile, glabrous, obovoid-oblong, truncate, very strongly compressed, not winged, scarcely nerved. Pappus usually none, occasionally represented by two short, slender bristles or by a pair of callous thickenings.—Erect shrubs or trees commonly with resinous or gummy sap, and with sericeous, villous, scabrous, or glandular foliage and branchlets or rarely subglabrous. Leaves well-developed and more or less clustered at the ends of branchlets, alternate or rarely opposite, sometimes both alternate and opposite leaves on the same branch, varying from nearly linear to suborbicular, and from entire to bi- or tri-pinnatifid, petiolate to subsessile, the blade acute, obtuse, or acuminate at apex, cordate, truncate, or cuneate at base, sometimes decurrent as a broad or narrow wing to the base of the petiole, the lateral veins widely divaricate and ending in a marginal tooth or lobe, or the lowest pair upwardly curved towards the apex of the leaf and either confluent with the other lateral veins or forming a distinct, submarginal vein. Heads small or medium-sized (0.5–3 cm. broad), pedunculate or rarely almost sessile, mostly solitary or few at the ends of branchlets, or rarely several corymbosely arranged in a short leafy cluster, the corollas white.

Scalesia Arn. in Lindl., Nat. Syst. Bot., 443 (1836); DC. Prod., **7**: 308 (1839); Hook. and Arn., in Hook., Jour. Bot. **3**: 312 (1841); Benth. and Hook. f., Gen. Pl. **2**: 195, 367 (1873); O. Hoffm. in Engl. and Prantl, Nat. Pflanzenfam., **IV**, 5: 228, 232 (1894); Lemée, Dict. Gen. Pl. Phanérog., **5**: 996 (1934).

No satisfactory derivation of the name *Scalesia* has been found. Translating Hooker and Arnott's description of the style-appendage, Wittstein (Etymologisch-botanisches Handwörterbuch, ed. 2, 1856) gives the following, far-fetched derivation: "Von *scala* (Treppe), über den Griffel hinaus befindet sich ein spitzer Kegel, dessen Behaarung von der Basis an auf und ab steigt."

The following abbreviations indicate the herbaria in which specimens have been studied: CAS, Herbarium of the California Academy of Sciences; B, Herbarium of the Brooklyn Botanic Garden; DS, Dudley Herbarium, Stanford University; G, Gray Herbarium, Harvard University; K, Royal Herbarium, Kew; Cantab., Herbarium of the University of Cambridge; Holm., Herbarium of the Museum of Natural History, Stockholm.

Key to the Series

a. Leaves mostly regularly serrate to entire, the lowest pair of lateral veins curved strongly upward, either confluent with the upper lateral veins or extending to the apex of the leaf as a submarginal vein. (In *S. aspera* in the *Dentatæ* the lateral veins sometimes end in a marginal tooth.)

b. Outer phyllaries equalling or shorter than the disk, if slightly exceeding the disk, then the leaves serrate and the heads radiate.

c. Pubescence on branchlets villous or glandular and spreading, or scabrous and subappressed; leaves serrate (sometimes subentire in *S. villosa*, *S. aspera*, and *S. Crockeri*), petioles winged or unwinged.....Series 1. Dentatæ (p. 241)

cc. Pubescence on branchlets sericeous or, if tomentulous or villous, the plants arboreous; leaves entire, undulate or occasionally obscurely crenulate; petioles unwinged.....Series 2. Pedunculatæ (p. 250)

bb. Outer phyllaries foliaceous and exceeding the disk; leaves entire .....Series 3. Foliaceæ (p. 258)

aa. Leaves deeply and irregularly serrate to twice or thrice pinnatifid, the lateral veins widely divaricate and ending in a tooth or lobe on the margin. (In *S. divisa* the lowest pair of lateral veins extend upward, and either end in a lobe or are confluent with the other lateral veins.).....Series 4. Lobatæ (p. 261)

Series 1. **Dentatæ**, ser. nov.

Frutices, ramulis pilis villosis glandulosisve patentibus vel scabris subappressis vestitis; foliis anguste lanceolatis ad late ovatis vel rotundatis, trinervatis ex basi, plerumque regulariter serratis, petiolis alatis vel exalatis; capitulis homogamis discoideisque vel heterogamis radiatisque; phyllariis exterioribus disco brevioribus vel paullum longioribus.—Species typica, *S. affinis* Hook. f.

Shrubs, the branchlets with villous or glandular spreading pubescence, or scabrous subappressed pubescence; leaves narrowly lanceolate to broadly ovate or roundish, 3-nerved from base, usually regularly serrate, petioles winged or unwinged; heads homogamous and discoid, or heterogamous and radiate; outer phyllaries shorter than, or a little longer than, the disk.—The type species, *S. affinis* Hook. f.

Key to the Species

a. Heads radiate.

b. Inner pales with triangular-deltoid lobes, the middle lobe not more than twice as long as broad.....1. *S. affinis*

bb. Inner pales with lanceolate to linear-lanceolate lobes, the middle lobe usually more than twice as long as broad..2. *S. gummifera*

aa. Heads discoid.

c. Leaves lanceolate, sparsely to conspicuously villous, margin more or less revolute; lobes of pales triangular-deltoid....3. *S. villosa*

cc. Leaves narrowly to broadly ovate, scabrous to subsericeous, margin not revolute; lobes of pales elongate, oblong or linear.

d. Petioles not at all winged; phyllaries broadly ovate, imbricated in 3 or 4 series.....4. *S. aspera*

dd. Petioles generally winged; phyllaries oblong, loosely imbricated in 2 or 3 series.....5. *S. Crockeri*

1. Scalesia affinis Hook. f.
Trans. Linn. Soc. **20**: 212 (1847)

Shrub 0.3–3.5 m. tall with a main trunk and generally few branches with leaves clustered near the ends, stems with brownish bark, the ends of the branchlets subvelutinous to villous, the pubescence sometimes sparse; leaves usually alternate or sometimes opposite or nearly opposite, light to dark olive-green, ovate, or if wings on the petiole are especially broad, rhomboidal, 7–18 cm. long, 3–12 cm. wide, serrate, acute, decurrent in broad or narrow wings along the petiole, more or less semiamplexicaul at the very base, pubescent above and below, the pubescence subsericeous or villous, sometimes scant, not becoming harsh in age, somewhat glandular, the lowest pair of veins prominent and projected strongly forward; heads 1 to 3 at the ends of branchlets, radiate, broadly campanulate, 1.5–2 cm. broad, 1–1.5 cm. long, exceeded by the leaves, peduncles 3–6.5 cm. long, hirsutulous and glandular, apparently not leafy-bracted; phyllaries in about 3 series, the outer and middle ovate to almost orbicular, or sometimes narrower and ovate-oblong, 5–9 mm. long, 2–8 mm. wide, equalling or much shorter than the disk, acute, thinly pubescent or subvillous, indurate at base in age; pales 7–9 mm. long, 3-lobed at the apex, the lobes broadly lanceolate to triangular-deltoid and bearing short stiff trichomes, the middle lobe of the central pales not more than twice as long as wide; rays several, about 8 mm. long, toothed at the apex; disk-flowers numerous, corolla 6 mm. long, the lobes spreading, papillose-ciliate, the outside glabrous, except for a few hairs near the tips of the lobes and near the base of the corolla-tube; anthers exserted, the appendages about 0.5 mm. long; style-branches about 1 mm. long; achenes 2.5–4 mm. long, without pappus, rarely with callous rudiments.

References. Walp., Ann. Bot., **1**: 414 (1848–9); Ands., Kgl. Vet. Akad. Handl., 1853: 89, 182 (1855); Ands., Bot. Eugenies Resa, 17 (1857), 71 (1861); Hemsl., in Hook. Icon., pl. 2718 (1901); Rob., Proc. Amer. Acad., **38**: 216, 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156 (1911), Trans. Wisc. Acad., **18**: 301 (1915); Riley, Kew Bull., 1925: 223.

S. decurrens Ands., Kgl. Vet. Akad. Handl., 1853: 182 (1855); Ands., *op. cit.*, 77, 89; Walp., Ann. Bot. **5**: 220 (1858); Ands., Bot. Eugenies Resa, 10, 17 (1857), 71 (1861); Rob., Proc. Amer. Acad., **38**: 216 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad., **18**: 297 (1915); Christoph., Nyt Mag. for Naturvid., **70**: 95 (1932); Svenson, Amer. Jour. Bot., **22**: 218, 259 (1935).

S. decurrens f. *denudata* Ands., Kgl. Vet. Akad. Handl., 1853: 182 (1855); Ands., Bot. Eugenies Resa, 71 (1861).

Collections studied. Charles Island: *Darwin* (Cantab., type; drawings, K); *Andersson* (Holm., type of *S. decurrens;* G); *Andersson No. 94* (K; drawing, G); *Snodgrass and Heller No. 410* (DS, G); *Stewart No. 671* (CAS, G); *Stewart No. 661* in part (G); *Hicks on St. George Expedition No. 422* (K); Black Beach, *Crocker in 1932* (CAS), *Howell No. 8906* (CAS). Indefatigable Island: Academy Bay, *Svenson No. 239* (B), *Schimpff No. 66* (CAS, Holm.); Conway Bay, *Chapin No. 1140* (B).

Scalesia affinis is very near *S. gummifera* Hook. f., under which the relationship is discussed.

Until now, *S. affinis* and *S. decurrens* Ands. have been maintained as distinct species, but I have not found enough difference between specimens referred to them even to recognize *S. decurrens* as a variety. When studying in Europe in 1935 I thought that "*S. affinis* and *S. decurrens* are probably separable as species on the characters of

leaf-bases (those of *S. decurrens* being so much broader and less attenuate), the more ovate-oblong phyllaries in *S. decurrens* which in that species equal the pales, and the differently shaped tips of the pales" (notes made in Stockholm, July 31, 1935). But after studying the considerable number of specimens cited above, these characters are not now regarded as decisive or critical. In a single collection (*Howell No. 8906*) which was taken to Europe as a basis for comparison with authentic specimens, the leaf-bases of one part matched the leaf-bases of the type of *S. affinis* while the leaf-bases of another part matched those of the type of *S. decurrens*. Taxonomic value has not been attached to the relative lengths of phyllaries and pales, since these differences do not seem to be correlated with any other variations, or with geographic distribution. And the point noted in Stockholm about the differences in the lobes of the pales has not been regarded as critical, since the different shapes observed may be found between pales in the outer and inner parts of the same head. In this work the shape of the pales in the inner part of the head is taken as typical of a species.

No specimen has been seen which carries Andersson's designation *S. decurrens* f. *denudata*, and the plant so-named probably represents only a trivial variant. Neither the leaves of the type in Stockholm nor the leaves of the other Andersson collections examined can be described as "dense incano-tomentosa" as was done by Andersson in the original description of the species.

While I was working at Kew, Dr. T. A. Sprague borrowed from the Herbarium of the University of Cambridge the types of those species of *Scalesia* not represented at Kew, and so it was possible to compare the type of *S. affinis* with the drawings in Herb. Kew., and with the plate in Hooker's Icones, No. 2718. Unfortunately certain details of foliage depicted in the plate are neither like the corresponding parts in the plant specimen nor in the original sketches, and these details were the very ones mentioned by Robinson (1902, p. 219) when he discusses the relationship of his newly described *S. narbonensis* to *S. affinis*. In the plate the openly spaced leaves are shown to be distinctly opposite and petiolate, and the lateral veins of the blade are nearly or quite simple. In the type the leaves are crowded, the arrangement is mostly alternate (although a pair may seem to be opposite, due perhaps to the foreshortening of the upper internodes), the base of the leaves is more definitely cuneate, the wings on the petioles are even broader than the wings in the type of *S. gummifera* Hook. f., and the lateral veins of the blade are branched in the manner typical of this series of the genus. The original sketches depict the plant as it appears in the type, the printed plate is a composite of details which give an inaccurate idea of the type.

Two specimens in Herb. Calif. Acad. Sci. collected by Stewart, are here referred to *S. affinis*, but they are not typical and may represent varities worthy of recognition when they are understood

more fully. *Stewart No. 661* (in part) has the broad, dentate leaves and radiate heads of *S. affinis*, but the pubescence of the upper stems and the phyllaries is more like that of *S. villosa* Stew. Since this plant was collected with a typical aspect of *S. affinis* (*Stewart No. 661* in Herb. Gray.) in a region noted by Stewart for the occurrence of *S. villosa*, we suspect that this plant, which is intermediate in aspect between the two species, may be a seggregate of a cross between the two species.

The other atypical collection of *S. affinis* is *Stewart No. 663* (CAS) from the southeastern side of Indefatigable Island. Though the heads are radiate, and the petioles more or less bordered to the base as in *S. affinis*, the harshly pubescent and coarsely serrate leaves and the small, ovate-lanceolate phyllaries are much more like the corresponding parts in *S. aspera* Ands., to which Stewart referred the collection (1911, p. 156). The material is entirely inadequate for a proper estimate at this time, but the collection of further material may disclose an entity worthy of taxonomic recognition. (See further discussion of this collection under *S. aspera*).

Scalesia affinis is one of the early colonizers on new lava flows, and has usually been found at low elevations not far distant from the sea. Low leafy plants of *S. affinis* are clearly depicted with *Cereus Thouarsii* Weber in the picture of vegetation at Black Beach, Charles Island, in Bull. Mus. Comp. Zool., Harv. College, vol. 23, no. 1, pl. 20.

2. **Scalesia gummifera** Hook. f.
Trans. Linn. Soc. **20**: 212 (1847)

Compactly or loosely few-branched shrubs 0.3–2 m. tall with brown branches and villous or subhirsutulous branchlets; leaves more or less clustered at the ends of branchlets, usually alternate, rarely opposite or even whorled by the foreshortening of the upper internodes, light to dark olive-green, ovate to ovate-lanceolate or rhomboidal, 3.5–15 cm. long, 1–8 cm. wide, serrate, acute, cuneate-attenuate at base, pubescent above and below and somewhat glandular, pubescence subsericeous at first, becoming sparse and harsh in age, the lowest pair of veins prominent, projected strongly forward toward the apex of the leaf where they are confluent with other lateral veins, petiole either unwinged or narrowly to rather widely winged below the cuneate base of the blade; heads one or two at the ends of branchlets, radiate, cylindric to campanulate, 1–1.3 cm. long, 0.7–1.5 cm. wide, usually exceeded by the uppermost leaves, peduncles 1–6 cm. long, frequently bearing a single reduced leaf about the middle and occasionally a bract-like leaf just below the head; phyllaries in 2 or 3 series, the outermost narrowly oblong to oblong-ovate, 8–12 mm. long, 2–5 mm. wide, equalling or a little shorter than the disk, subacute, indurate at base in age, pubescence similar to that of the leaves; pales trifid, the middle division longer than the lateral, the divisions narrow and acuminate, pilose and frequently appearing like subplumose tails; rays about 10, 7–9 mm. long, somewhat irregularly 2- or 3-lobed at apex; disk-flowers numerous, corolla 5–7 mm. long, the lobes spreading, papillose-ciliate, the outside glabrous except for a few hairs near the tip of the lobes and near the base of the corolla-tube; anthers conspicuously exserted, the appendage 0.75–1 mm. long; style-branches 1.2–1.6 mm. long; achenes without pappus, 2.5–3.5 mm. long.

References. Walp., Ann. Bot., **1**: 414 (1848–9); Ands., Kgl. Vet. Akad. Handl., 1853: 83, 90, 182 (1855); Ands., Bot. Eugenies Resa, 13, 17, tafl. 7, fig. 2 (1857), 71 (1861); Rob., Proc. Amer. Acad., **38**: 217, 244 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad., **18**: 282, 289 (1915); Riley, Kew Bull., 1925: 223.

S. narbonensis Rob., Proc. Amer. Acad., **38**: 218, pl. 3, fig. 4–7 (1902); Stew., Proc. Calif. Acad. Sci., (4), 1: 158 (1911), Trans. Wisc. Acad., **18**: 335 (1915).

Collections studied. Albemarle Island: *Macrae* (K: Herb. Hook., type; Herb. Benth.); *Andersson* (Holm.); *Cheesman on St. George Expedition No. 453* (K); Tagus Cove, *Snodgrass and Heller No. 150* (G), *Howell No. 9520* (CAS); Elizabeth Bay, *Snodgrass and Heller No. 266* (DS, G); Cowley Bay, *Stewart No. 673* (CAS, G); Black Bight, *Blair on St. George Expedition No. 447* (K); eastern side, 3 miles south of Equator, *Howell No. 9627* (CAS); 5 miles northeast of Webb Cove, *Howell No. 9445* (CAS); Villamil, *Stewart No. 674* (CAS, G), *Howell No. 8943* (CAS). Narborough Island: northern part, *Snodgrass and Heller No. 297* (G, type of *S. narbonensis*, the first-cited specimen), *Stewart No. 680* (CAS, G); southern side, *Snodgrass and Heller No. 341* (DS, G).

Scalesia gummifera is very closely related to *S. affinis* Hook. f., and together they present one of the most puzzling aggregates of variations in the Galapagos Islands. Very easily the aggregate might be treated as a single species with one or more named varieties. It has seemed better, however, to recognize two species, which may be separated in a decided manner by the excellent character of the pales, a character which is well correlated with the insular distribution of the entities. Besides this character, there are several differences in foliage and flowers, which, while they do not hold in every instance, add weight to the opinion that the entities should be accepted as species.

As indicated above, there are two specimens in Herb. Kew. collected by Macrae, one in Herb. Hook., the other in Herb. Benth. The former should be taken as the type. In it the leaf-blade is decurrent along the petiole even to its base, although the foliar border becomes very narrow and attenuate. In the other specimen, which bears a printed label, "Herb. Soc. Hort. Lond. Macrae. 1925", the base of the blade is attenuate-cuneate, but below this is a definite unwinged petiole. In Herb. Gray. there is a tracing of this type of leaf which compared favorably with the leaves of *Howell No. 9520.*

In *S. gummifera*, the character of the unbordered petiole has not been found definite enough for the segregation of a taxonomic entity. For example, in *Howell No. 9627* from eastern Albemarle, which is represented by several branches from the same bush or adjacent bushes, petioles both winged and unwinged are to be found, the leaves on a vigorous, actively growing shoot having winged petioles while those on smaller, less vigorous branchlets having mostly unwinged petioles. In most collections only one type of leaf

is shown (perhaps because most earlier collections are represented by only a single branch), although successive collections from the same locality may exhibit winged and unwinged petioles (cf. *Stewart No. 614* and *Howell No. 8443* from Villamil).

The decision to treat as representative of a single entity specimens with petioles narrowly winged or unwinged leads inevitably to the reduction of *S. narbonensis* Rob. When Robinson originally described *S. narbonensis* from Narborough Island, he did not relate it to *S. gummifera*, which grew on the closely adjacent island of Albemarle, but rather to *S. affinis*, which grew on the much more distant islands of Indefatigable and Charles. The reason for this was undoubtedly because of the broader campanulate heads of the Narborough plant. More numerous recent collections from Albemarle Island have shown that the shape of the heads in *S. gummifera* varies from cylindric-campanulate to hemispheric-campanulate; and, although the two extremes probably represent different genetic strains, it would seem that no taxonomic line should be drawn between them at present. The emphasis placed on other characters by Robinson when he compared *S. affinis* and *S. narbonensis* is not of importance, when one appreciates the inaccuracies depicted in the plate of *S. affinis* (Hook. Icon. pl. 2718) which Robinson used as a basis for his comparision and discussion. The plate is discussed under *S. affinis*.

Probably the most significant variant to be noted in *S. gummifera*, however, comes from Villamil on the southern shore of Albemarle Island. The campanulate heads and the broad oblong-ovate or ovate phyllaries are very similar to those of *S. affinis*, but the pales are distinctly those of *S. gummifera*. Nevertheless this plant from southern Albemarle is undoubtedly intermediate between the two species. It may well be that the Villamil plant is the descendent of that form of *S. affinis* which first reached Albemarle Island from Charles Island, borne thither in a direct line on the Southeast Trade Winds and the Humboldt Current. Except for the plant from Cowley Bay, on the eastern side of Albemarle Island, all the forms of *S. gummifera* that have been seen differ from the Villamil plant, a divergence in character one might expect if the dispersal of *S. gummifera* took place from the south to the north. The plant from Cowley Bay (*Stewart No. 673*) is more or less intermediate between the Villamil plant and the typical form in the western and northern parts of Albemarle. Variations in plants from different parts of Albemarle and Narborough islands are such that these southern plants are scarcely susceptible of taxonomic segregation.

As in the case of the closely related *S. affinis*, *S. gummifera* grows on relatively fresh lava, generally near the coast. The collection made by Snodgrass and Heller (*No. 341*) on the southern side of Narborough Island is the most marked departure from the usual lowland habitat, it having been collected at an elevation of 2000 ft.

The less xerophytic character of this specimen is problably due to the elevation at which it was collected.

At the locality on the west side of Albemarle Island 5 miles northeast of Webb Cove, a fungus was collected on the leaves of *S. gummifera*. This has recently been described as *Uredo Scalesiæ* Bonar (1939, p. 201).

3. **Scalesia villosa** Stewart

Proc. Calif. Acad. Sci., (4), **1**: 158, pl. 4, fig. 1–3 (1911)

Shrubs 2–3 m. tall, the stems with brownish-gray bark, the branchlets villous with long, silky hairs; leaves grayish-green, clustered at the ends of the branchlets, alternate, lanceolate, 3–10 cm. long, 0.5–2 cm. wide, attenuate at apex, at base gradually narrowed to the short bordered or scarcely bordered petiole, the margin narrowly revolute, entire or undulate, occasionally obscurely serrulate especially on the larger leaves, sericeous-villous above and below and with short, glandular hairs intermixed among the long, slender, silky ones, sometimes becoming more or less scabrous, the hairs rather sparse except along the veins and margins, the apices almost penicillate, the lowest pair of lateral veins prominent, extending nearly to the end of the leaf very near the margin; heads one to several at the ends of branchlets, broadly campanulate, 12–13 mm. long, becoming subglobose in age and 1.5–2 cm. in diameter, peduncles villous-tomentose, 2.5–6 cm. long, usually surpassed by the leaves; phyllaries loosely imbricated in 2 or 3 series, lanceolate-oblong, 8 mm. long, 2–3 mm. wide, subacute, sericeous-villous; pales 8 mm. long, the lobes triangular-deltoid and not more than twice as long as broad; rays none; disk-flowers numerous, corolla 5–6 mm. long, the tube and lower part of the throat villous-hairy, the upper part subglabrous or glabrous; anther-appendage lanceolate, acute, 1 mm. long; style-branches about 1.5 mm. long; achene oblong-obovate, 2.5–3 mm. long; pappus none.

References. Stew., Trans. Wisc. Acad., **18**: 300, 301 (1915); Riley, Kew Bull., 1925: 224; Christoph., Nyt Mag. for Naturvid., **70**: 95 (1932).

S. villosa var. *championensis* Stew., Proc. Calif. Acad. Sci., (4), **1**: 159 (1911).

S. Darwinii Rob. and Greenm., Amer. Jour. Sci., (3), **50**: 146 (1895), not Hook. f.; Rob., Proc. Amer. Acad., **38**: 216 (1902), in part.

Collections studied, all from Charles Island: Cormorant Bay, *Baur No. 107* (type, G), *Stewart No. 692* (CAS); *Hornell on St. George Expedition No. 411* (K); 2 or 3 miles south of Post Office Bay, *Howell No. 9371* (CAS).

Scalesia villosa is a very distinct species most closely related to *S. affinis* Hook. f. but differing from it in excellent characters of foliage and flowers. In appearance it looks more like the narrow-leaved species endemic on James Island, but the venation and serration of the leaves, the character of the heads and the phyllaries, and the lobing of the pales are very distinctive and different. The flowers of this species have not been described heretofore.

From a specimen collected by Mr. J. R. Slevin on Champion Island, an islet northeast of Charles Island near Cormorant Bay, Stewart described *S. villosa* var. *championensis* (type, CAS). The material is scarcely adequate for determining the value of this

entity, which is distinguished from the species on Charles Island by the somewhat broader, more sparsely villous leaves with more prominently revolute margins.

4. Scalesia aspera Ands.
Kgl. Vet. Akad. Handl. 1853: 180 (1855)

Shrubs 1–3.3 m. tall, the stems dark brownish, the branchlets scabrous with short scattered upwardly appressed hairs; leaves dark olive-green, not densely clustered at the ends of the branchlets, alternate or occasionally opposite, ovate, 3.5–10 cm. long, 1.5–6 cm. wide, scabrous above and below with short, stiff, subappressed trichomes, serrate, crenulate-serrate, undulate or subentire, acute, at base broadly to narrowly cuneate, or attenuate and decurrent along half the length of the petiole or less, petiole 0.5–2 cm. long, scabrous with outwardly curved hairs, the lowest pair of lateral veins not very prominent, extending forward, but frequently ending in a tooth about the middle of the leaf; heads solitary at the ends of branchlets, broadly campanulate, 1–1.5 cm. long, 1.5–2 cm. broad, peduncles scabrous, 2.5–10 cm. long; phyllaries in 2 to 4 series, oblong, ovate-oblong or suborbicular-ovate, acute or subobtuse, sparsely to densely scabrous-pubescent or merely hairy; pales 8–11 mm. long, strongly compressed-carinate, the lateral lobes of the trifid apex oblong-lanceolate, irregularly toothed or lacerate, a little wider than the middle triangular-lanceolate lobe; rays none; disk-flowers numerous, 6–7 mm. long, the lobes papillose-ciliate and bearing a few trichomes on the lower side, the tube and lower part of the throat with short, upwardly appressed hairs; anther-appendage about 0.6 mm. long, narrowly ovate; style-branches short, 0.8 mm. long, triangular, penicillate; achenes 4–5 mm. long; pappus reduced to two callous spots.

References. Ands., Kgl. Vet. Akad. Handl., 1853: 81, 89 (1855); Walp., Ann. Bot. **5**: 219 (1858); Ands., Bot. Eugenies Resa, 12, 17, tafl. 7, fig. 3 (1857), 70 (1861); Rob., Proc. Amer. Acad., **38**: 216 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156 (1911); Svenson, Amer. Jour. Bot., **22**: 216 (1935).

Only two collections typical of *S. aspera* have been studied, both from Indefatigable Island: *Andersson* (Holm., type; G); northwestern side, *Stewart No. 664* (CAS, G).

Although in this work *S. aspera* is placed in the series *Dentatæ*, it appears to be more nearly related to *S. divisa* Ands. of the series *Lobatæ* than to any other species. In both of these species the venation of the leaves is sometimes irregular: in *S. divisa* the veins do not always branch widely and end in a marginal lobe, and in *S. aspera* the lowest veins do not always extend up towards the end of the leaf. Although each of these species is somewhat anomalous in its respective series, *S. divisa* with its leaves deeply and frequently doubly serrate seems best referred to the series *Lobatæ* nearest *S. incisa* Hook. f.; and *S. aspera* with its leaves serrate or subentire seems best referred to the series *Dentatæ* as a remote, irradiate relative of *S. affinis* Hook. f. Lack of sufficient collections makes it difficult to appraise these entities properly from the point of view of possible relations and phylogeny.

A third collection is tentatively referred to this species, *Stewart No. 662* (CAS, G), from the southeastern side of Indefatigable Island at 600 ft. This plant differs most markedly from typical

S. aspera in the vesture, there being none of that harshness on branchlets and leaves that is so characteristic of the species. The collection was originally reported by Stewart (1911, p. 156) as *S. affinis* and this is not surprising since it is more like the plate of *S. affinis* in Hooker's Icones (No. 2718) than is the type itself. This plant from Indefatigable Island differs from real *S. affinis*, however, in the entirely unbordered petioles, the eradiate heads, the somewhat narrower phyllaries, and the more slender lobes of the pales. Between the specimens in Herb. Calif. Acad. Sci. and Herb. Gray. there is some difference in appearance since in the latter specimen the pubescence on the branchlets is more villous-tomentose and the pubescence on the young leaves is sericeous and denser. There is no doubt that the specimens are immediately related but they probably came from different bushes.

This collection, with the homogamous heads of *S. aspera* and the villous or sericeous vesture of *S. affinis*, is as anomalous in *S. aspera* as Stewart's *No. 663*, with the heterogamous heads of *S. affinis* and the harsh pubescence of *S. aspera*, is in *S. affinis*. Each is probably worthy of nominal recognition, but since they grow near each other on the southeastern side of Indefatigable Island, the possibility that they are segregates from a hybrid complex derived from a cross between *S. affinis* and *S. aspera* seems very probable. This relation between these two forms is not one to be solved in the herbarium with the examination of three specimens, but, as has been pointed out in our discussion of *Stewart No. 663* under *S. affinis*, must await detailed field work and the collection of adequate material.

5. **Scalesia Crockeri** Howell, spec. nov.

Frutex humilis rotundatus 0.6–1 m. altus, caulibus fuscis, ramulis pilis paucis multisve stipitato-glandulosis intermixtis trichomis patentibus elongatis albis vestitis; foliis atrovirentibus, resinoso-fragrantibus, trinervatis, dense aggregatis apicibus ramulorum, oppositis, ovatis ad suborbicularibus, 3–7 cm. longis, 1–6.5 cm. latis, glandulosis et scabris, serratis ad tenuiter crenulato-serrulatis vel subintegris, apice rotundatis mucronatisque vel acutis, basi abrupte vel gradatim attenuatis in conspicue alatum vel exalatum petiolum; capitulis solitariis apice ramulorum, cylindraceo-campanulatis, 1.5 cm. longis, circa 1 cm. latis, pedunculis 2.5–4 cm. longis, scabris glandulosisque, foliis equalibus vel brevioribus; phyllariis 2- vel 3-seriatis, vix imbricatis, sæpe oblongis, subacutis, glandulosis et scabris; paleis circa 8 mm. longis, fere profunde trifidis, lobis acuminatis, in latitudine subæqualibus, in longitudine lobo medio lateralibus paullum longiore, lacerato-scariosis vel serrulatis infra, ciliatis pubescentibusve supra; radiis nullis; floribus disci circa 20, corollis 6–8 mm. longis, tuba glabra, ⅓–½ longitundine faucis, lobis recurvatis; acheniis oblongo-oblanceolatis, 4.5–5 mm. longis; pappo nullo.

Low, rounded, leafy shrubs 0.6–1 m. tall, the stems brown, the branchlets sparsely to densely stipitate-glandular with scattered elongate, spreading, white trichomes interspersed among the glandular hairs; leaves dark green, resinous-fragrant, densely clustered at ends of branchlets, opposite, ovate to suborbicular-ovate, 3–7 cm. long, 1–6.5 cm. wide, serrate to shallowly crenulate-serrulate or subentire, rounded and mucronate at apex or acute, at base abruptly or gradually narrowed to conspicuously

winged petiole, the wing as much as 2.5 cm. wide, the base of the wings sometimes auriculate-expanded or adjacent edges of the wings of opposite leaves shortly connate, rarely petioles unwinged, vesture of leaves glandular and scabrous, the scattered harsh trichomes interspersed among numerous stipitate glands, the lowest pair of lateral veins prominent, directed forward towards the upper part of the blade; heads solitary at the ends of branchlets, cylindric-campanulate, 1.5 cm. long, about 1 cm. wide, peduncles 2.5–4 cm. long, scabrous with rough spreading trichomes and shorter glandular hairs, equalling or shorter than the leaves; phyllaries scarcely or loosely imbricated in 2 or 3 series, mostly oblong, subacute, glandular and scabrous; pales about 8 mm. long, rounded but not carinate, rather deeply trifid, the lobes acuminate, about equally wide, the middle a little longer than the lateral, lacerate-scarious or serrulate below, ciliate and pubescent above; rays none; disk-flowers about 20, corolla 6–8 mm. long, the tube ⅓–½ as long as the throat and glabrous, the throat hairy below and on the veins above, the lobes recurved, hairy on the outside at the tips; anther-appendage ovate, about 1 mm. long; style-branches about 1.5 mm. long, the tip curved and hairy; achenes oblong-oblanceolate, 4.5–5 mm. long; pappus none.

Type: No. 272130, Herb. Calif. Acad. Sci., on marine bluffs on the south side of **North Seymour Island,** *Howell No. 9992*, Templeton Crocker Expedition, June 11, 1932, a single collection only.

So far as we know, this is the first *Scalesia* to be collected on either of the Seymour islands, and it represents another of the distinctive elements in the floral district comprising those islands and adjacent northern Indefatigable Island. It combines in a most puzzling way characters of *S. aspera* Ands. and *S. affinis* Hook. f., but from one or the other of those species it may be separated by characters of foliage and vesture, and from both it is different in the more slender heads, the narrower more loosely imbricated phyllaries, and the more acuminate lobes of the pales.

Stewart's collection from the northern side of Indefatigable Island, *No. 665* (CAS), is inadequate for proper study, but may be either *S. Crockeri*, or a form intermediate between *S. Crockeri* and *S. aspera*. In this specimen, the leaves are either alternate or opposite and lack the broadly winged petioles so conspicuous in the type from North Seymour Island.

Series 2. **Pedunculatæ,** ser. nov.

Arbores vel frutices, ramulis pilis sæpe sericeis interdum scabris villosisve vestitis; foliis lanceolatis ad late ovatis, trinervatis ex basi, plerumque integris, petiolis exalatis; capitulis homogamis et discoideis; phyllariis exterioribus et disco subæqualibus.—Species typica, *S. pedunculata* Hook. f.

Trees or shrubs, the branchlets usually sericeous, sometimes villous or scabrous; leaves lanceolate to broadly ovate, 3-nerved from base, usually entire, petioles unwinged; heads homogamous and discoid; outer phyllaries about equalling the disk. —The type species, *S. pedunculata* Hook. f.

Key to the Species

a. Leaves broadly to narrowly lanceolate, cuneate at base; peduncles 5–15 cm. long (or occasionally shorter in var. *parviflora*); heads 1–3 cm. broad.....6. *S. pedunculata*

aa. Leaves ovate-lanceolate to ovate, at base subtruncate to cordate or sometimes very shortly cuneate; peduncles 0.5–2.5 cm. long; heads 0.5–0.7 cm. broad.

b. Arborescent shrub 2–4 m. tall; leaves rounded, subtruncate or very shortly cuneate at base.....7. *S. microcephala*

bb. Tree about 9 m. tall; leaves broadly cordate at base.....8. *S. cordata*

6. **Scalesia pedunculata** Hook. f.

Trans. Linn. Soc. **20**: 211 (1847)

Low to tall trees 5–20 m. tall with long straight trunks 2–3 dm. in diameter; branchlets not glandular, appressed-pubescent and more or less sericeous, becoming glabrate, or in var. *pilosa*, the hairs spreading, denser, and more persistent; leaves alternate or sometimes nearly or quite opposite, lanceolate to ovate-lanceolate and ovate, 4–20 cm. long, 1–10 cm. wide, appressed-pubescent, dark or light green to somewhat cinereous, nonglandular, the tip attenuate-acute, the base abruptly or more gradually cuneate, margin entire or rarely minutely crenate-serrulate, petiole 0.5–5 cm. long; heads 1 to 3 near the ends of the branchlets, 1–3 cm. broad, usually long-pedunculate, peduncles 5–15 cm. long, rarely a little shorter, thinly appressed-pubescent and glabrate, or rarely persistently and rather densely villous; involucres campanulate, about 1 cm. long, the phyllaries rather thin, or becoming more or less thickened and indurate in age, oblong-lanceolate to ovate-lanceolate, acute; pales 6–12 mm. long, the lobes truncate or obtuse to subacuminate; rays none; disk-flowers more than 20, corolla 5–6 mm. long, hairy on the tube and glabrous above, or hairy on the veins of the upper part of the tube and throat; anthers exserted, the appendage about 0.5 mm. long; achenes 3.5–7 mm. long, with or without rudimentary pappus.

Scalesia pedunculata has the widest distribution of any species in the genus and on account of its arboreous habit is one of the most remarkable. It occurs on the four larger and higher central and southeastern islands of the archipelago, and on each it is one of the most numerous and important elements in the forest of the moist zone. Darwin was the first who called attention to the forests of *S. pedunculata* when he wrote: "Characteristic of the vegetation of James Island, forming woods of straight trees in the alpine or damp region" (Trans. Linn. Soc. **20**: 211); and Stewart has described briefly the vegetation of what he aptly calls the "*Scalesia* forests" (1911, pp. 208, 209).

It was my privilege to visit the *Scalesia* forests on two of the islands, Charles and Indefatigable. To collect in the luxuriant "sunflower forest" on Indefatigable Island above Academy Bay was a botanical experience as unique in its way as to explore the impressive cactus groves of the arid lowlands. In the vicinity of Fortuna on Indefatigable Island, *Scalesia* was the most abundant tree in the rain-forest, and a distinctive note was imparted to the vegetation by the rounded bunchy crowns, supported by the tall

slender trunks covered with buff-brown shallowly broken bark, and clear of branches nearly to the top. The resemblance of the leaves to the leaves of *Helianthus* has already been noted by Svenson (1935, p. 215), and at the time of my visit I likened the entire tree to a gigantic sunflower, 10 to 20 m. tall. On Charles Island, not only did I collect in the *Scalesia* forest in the interior of the island between Floreana Peak and the spring, but I also viewed the top of the forest from the grass-covered summit of Floreana Peak. From this summit one looks down nearly a thousand feet into the crater, the lower inner slopes and floor of which are covered with a rain-forest of tropical luxuriance. In this forest the rounded, bright green crowns of the *Scalesia* are conspicuous, and, from the vantage point of the crater-rim, appear to be more abundant than any other tree.

A review of the material of this remarkable species has shown that it is not uniform in character, and, as in other variable species in the flora of the Galapagos Islands, the variations have become more or less segregated among the several islands where the species occurs. As a result of this study, five variants have been recognized and named according to the key and diagnoses that follow.

KEY TO THE VARIETIES OF *Scalesia pedunculata*

a. Heads large, 2–3 cm. broad, 1.5 cm. long; phyllaries oblong-lanceolate; achene 5.5–7 mm. long ..... 6a. var. *typica*

aa. Heads smaller, 1–2 cm. broad, 1–1.5 cm. long; achene 3.5–5 mm. long.

b. Pubescence appressed or subappressed, sericeous on young parts, the peduncles early glabrescent.

c. Phyllaries relatively thin and flat, not becoming conspicuously indurate or thickened; achenes without rudiments of pappus.

d. Heads 1.5–2 cm. broad; phyllaries ovate or oblong-ovate; lobes of pales oblongish, subobtuse to truncate ..... 6b. var. *Svensoni*

dd. Heads 1–1.5 cm. broad; phyllaries oblong or oblong-lanceolate; lobes of pales triangular-lanceolate, acute ..... 6c. var. *parviflora*

cc. Phyllaries conspicuously thickened, indurate, and bowed; achenes with 2 rudimentary pappus callosities ..... 6d. var. *indurata*

bb. Pubescence of stems, petioles, and peduncles conspicuously and densely pilose-hirsutulous or villous, more or less persistent ..... 6e. var. *pilosa*

6a. **Scalesia pedunculata** var. **typica** Howell, nom. nov.

Pubescence appressed, the stems and peduncles early glabrate; peduncles 1–1.5 dm. long, rather stout; heads 2–3 cm. broad, 1.5 cm. long; phyllaries oblong-lanceolate, the outer obtuse or all acute, not becoming noticeably thickened; pales 10–12 mm. long, the lobes acute, the middle longer and wider than the lateral; flowers very numerous; achenes 5.5–7 mm. long; pappus none or represented by two small callosities.

References. *S. pedunculata* Hook. f., Trans. Linn. Soc. **20**: 211 (1847), in part; Walp., Ann. Bot., **1**: 414 (1848-9); Ands., Kgl. Vet. Akad. Handl., 1853: 90, 181 (1855); Ands., Bot. Eugenies Resa, 17 (1857), 71 (1861); Hemsl., in Hook. Icon., pl. 2717 (1901), in part; Rob., Proc. Amer. Acad., **38**: 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 in part, 208, 209 (1911), Trans. Wisc. Acad., **18**: 332 (1915).

Scalesia pedunculata in its typical form is known only from James Island where it was first collected by Darwin (Cantab., type; drawings, K), and later by Stewart (*No. 688*, CAS, G), who found "trees 25–40 ft. high" above 950 ft. at James Bay (1911, p. 158).

The only collection of *S. pedunculata* made by Darwin is in the Herbarium of the University of Cambridge, and consists of two specimens mounted on the same sheet that carries a single label. Although the two specimens obviously belong to the same species, they are quite unlike in details of aspect and parts, and in this treatment they are interpreted as two distinct varieties. The upper specimen on the sheet has three heads and in it the pubescence of the stems, petioles, and peduncles is rather densely hirsutulous-pilose. The heads in this specimen are less than 1.5 cm. in diameter. The lower specimen carries a single fruiting head, but near it in a pocket are fragments from a head removed from a second headless peduncle. In the lower plant the stems, petioles, and peduncles are appressed-pubescent, the stems and peduncles becoming glabrate. The head in the lower specimen is 2.5 cm. in diameter.

In his original description, Hooker covers about equally the characters of both specimens, so that it is difficult to say that one more than the other was in his mind as he wrote his description. But of the two it has seemed that the lower specimen has critical points in its favor and it has been chosen as the type of the species. In the preliminary diagnostic description, the leaves are described as "integerrimis." This applies to the leaves of the lower specimen but not to the leaves of the upper, in which the margin is very slightly undulate-crenate or serrulate, a serrulation now and again being rather prominent. Also in the preliminary description, the head on the lower specimen is better described by "late breviter campanulatis" than are those of the upper, in which the heads are not so noticeably low and broad. In the longer description that follows, first a character of one specimen and then of the other is described, though again the size of the heads, "circa ¾ unc. diametro," more nearly fits the lower specimen than the upper. So in this work the lower specimen is chosen as the type of *S. pedunculata* Hook. f. and the upper is named and described as var. *pilosa*.

The plate in Hooker's Icones Plantarum, No. 2717, is apparently drawn from both specimens. The habit drawing is that of the upper specimen and the enlarged details are undoubtedly taken from the lower plant. The fragments of the dissected head from the lower plant are in the pocket on the sheet.

6b. **Scalesia pedunculata** var. **Svensoni** Howell, var. nov.

Adpresso-pubescenti, pedunculis brevi glabrescentibus, 6–14 cm. longis, crassiusculis; capitulis 1.5–2 cm. latis, 1.5 cm. longis; phyllariis ovato-oblongis ad ovatis, acutis vel abrupte et breviter acuminatis, nec conspicue crassiusculis nec induratis; paleis 7 mm. longis, lobis in longitudine æqualibus et in latitudine subæqualibus, medio subobtuso, lateralibus truncatis vel irregulariter emarginatis; acheniis 4.5–5 mm. longis; pappo nullo.

Pubescence subappressed, the peduncles becoming glabrate early; peduncles 6–14 cm. long, rather stout; heads 1.5–2 cm. broad, 1.5 cm. long; phyllaries ovate to ovate-oblong, acute or abruptly short-acuminate, not conspicuously thickened or indurate; pales 7 mm. long, the lobes short and broad, equal in length and about equal in width, the middle lobe subotuse, the lateral truncate or irregularly emarginate; achene 4.5–5 mm. long; pappus-rudiments none.

References. *S. pedunculata* Hook. f., in part, Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911), Trans. Wisc. Acad., **18**: 316, 326 (1915); Svenson, Amer. Jour. Bot., **22**: 215, 259 (1935).

Type: Herb. Brooklyn Botanic Garden, collected by H. K. Svenson, *No. 118*, in the vicinity of the plantation, **6 miles north of Academy Bay at 750 ft., Indefatigable Island.** Duplicates in Herb. Gray. and Herb. Holm. Other collections studied, all from Indefatigable Island: northwest side above 700 ft., *Stewart No. 687* (CAS, G); Conway Bay, *Chapin No. 1139* (B); Academy Bay, "400 to probably 1500 ft.", *Stewart No. 685* and *No. 686* (leaves only, CAS); Fortuna (*i. e.*, "the plantation" of Svenson), *Howell No. 9172* (leaves only, CAS); forest region at 300 m., *Schimpff No. 83* (leaves only, CAS).

6c. **Scalesia pedunculata** var. **parviflora** Howell, var. nov.

Subappresso-pubescenti; pedunculis tenuiter pubescentibus demum glabratis, 4–10 cm. longis, gracilibus; capitulis 1–1.2 cm. longis, 1–1.5 cm. latis; phyllariis oblongis ad oblongo-lanceolatis, acutis, nec crassiusculis nec induratis; paleis 6–7 mm. longis, lobis acutis, in longitudine æqualibus, in latitudine interdum inæqualibus; acheniis 4–4.5 mm. longis; pappo nullo.

Pubescence subappressed, the peduncles thinly pubescent and at length glabrate; peduncles 4–10 cm. long, slender; heads 1–1.2 cm. long, 1–1.5 cm. broad; phyllaries oblong to oblong-lanceolate, acute, not becoming indurate or thickened; pales 6–7 mm. long, the lobes equal in length, sometimes unequal in width, acute; achene 4–4.5 mm. long, without pappus.

References. *S. pedunculata* Hook. f., in part, Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911), Trans. Wisc. Acad. **18**: 299, 321 (1915).

S. ovata Ands., Kgl. Vet. Akad. Handl., 1853: 181 (1855); Ands., *op. cit.*, 79, 89; Walp., Ann. Bot. **5**: 219 (1858); Ands., Bot. Eugenies Resa, 11, 17 (1857), 70 (1861); Rob., Proc. Amer. Acad., **38**: 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911); Svenson, Amer. Jour. Bot., **22**: 219 (1935).

Type: Herb. Calif. Acad. Sci. No. 12201, collected by Alban Stewart, *No. 683*, on exposures of basaltic lava, **1000 to 1200 ft., Charles Island,** Mar. 1, 1906. Duplicate in Herb. Gray.

Other collections studied. Charles: upper wooded region, *Andersson in 1852* (Holm., type of *S. ovata* Ands.); exposures of basaltic lava, *Stewart No. 681* and *682* (CAS, G). Indefatigable: southeastern side above 450 ft., *Stewart No. 689* and *690* (CAS, G); vicinity of the plantation, 6 miles north of Academy Bay, 550 ft., *Svenson No. 71* (B, G). As deduced from geographic distribution, Lee's collection (G) made in 1888 on Charles Island probably belongs here. It consists of a leafy twig without flowers. A fragmentary specimen in Herb. Kew., collected by Capt. Wood in the "Galapagos", would appear to belong to var. *parviflora*. In it the leaves are lanceolate, small, 3 cm. long; the peduncle is 3 cm. long; and the head is a little over 1 cm. broad.

An examination of the type of *S. ovata* Ands. showed it to belong to the small-headed variant of *S. pedunculata* on Charles Island. The type is very fragmentary with only a single head, so in proposing a new name for the arboreous *Scalesia* of Charles Island, it has seemed best to take for the type of the entity a more adequate specimen which would allow dissection and a more detailed study.

6d. **Scalesia pedunculata** var. **indurata** Howell, var. nov.

Adpresso-pubescenti, caulibus tarde pedunculis brevi glabrescentibus; pedunculis 8–12 cm. longis, crassiusculis; capitulis 1–1.5 cm. latis, circa 1 cm. longis; phyllariis oblongo-lanceolatis, acutis obtusisve, conspicue crassiusculis, costatis et induratis; paleis 8 mm. longis, lobis æqualibus, acutis vel subacutis; acheniis 4 mm. longis, 2 rudimenta pappi ferentibus.

Pubescence appressed, the stems tardily and the peduncles more promptly glabrescent; peduncles 8–12 cm. long, rather stout; heads 1–1.5 cm. broad, about 1 cm. long; phyllaries oblong-lanceolate, acute or obtuse, somewhat bowed, becoming conspicuously thickened, ribbed and indurate; pales 8 mm. long, the lobes equal, acute or subacute; achene 4 mm. long, with 2 rudimentary pappus-callosities.

References. *S. pedunculata* Hook. f., in part, Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911), Trans. Wisc. Acad., **18**: 306 (1915).

Type: Herb. Calif. Acad. Sci. No. 12200, collected by Alban Stewart, *No. 684*, on **Chatham Island above 600 ft.** at **Wreck Bay,** Jan. 27, 1906. Duplicate in Herb. Gray.

This plant, known only from the single collection cited above, is very near the arboreous *Scalesia* on Charles Island, and may be only a trivial form of it. However, in older heads the involucres are quite remarkable and it seems adequately distinct.

6e. **Scalesia pedunculata** var. **pilosa** Howell, var. nov.

Foliis, ramulis et pedunculis piloso-hirsutulis vel villosis, pubescentia subadpressa vel patente, haud glabrescentibus; pedunculis 10 cm. longis; capitulis circa 1–1.2 cm. latis; phyllariis griseo-pubescentibus, ovato-lanceolatis, acutis; acheniis 3.5 mm. longis; setis pappi circa 1 mm. longis.

Pubescence subappressed to spreading, pilose-hirsutulous or villous, the parts not glabrescent; peduncles 10 cm. long; heads about 1–1.2 cm. broad; phyllaries

griseous-pubescent, ovate-lanceolate, acute; achene 3.5 mm. long; pappus-bristles about 1 mm. long.

References. *S. pedunculata* Hook. f., Trans. Linn. Soc., **20**: 211 (1847), in part; Hemsl., in Hook. Icon., pl. 2717 (1901), in part.

Type: Herb. Cantab., collected by Darwin in 1835 on **James Island.**

As noted in the discussion under var. *typica*, the type of var. *pilosa* is mounted with the specimen selected in this work as the type of *S. pedunculata* Hook. f., and is the plant figured in the habit drawing in Hooker's Icones, pl. 2717. A comparison of the specimen in Herb. Cantab. with the figure disclosed that the peduncles in the specimen are much more densely pubescent with somewhat ascending hairs; and, whereas the leaves in the drawing are shown to be entire, those of the specimen are more or less crenulate or serrulate. With further botanical collecting on James Island, it is hoped that the distributional relation between var. *pilosa* and var. *typica* will be learned.

7. **Scalesia microcephala** Rob.

Proc. Amer. Acad. **38**: 218, pl. 3, fig. 2, 3 (1902)

Arborescent shrubs or low trees with a single trunk and rounded crown, 2–4 m. tall; branchlets pubescent or tomentulous, generally glabrescent, more or less resinous-glandular; leaves broadly lanceolate to ovate-lanceolate, 3–12 cm. long, 1–5 cm. wide, appressed-tomentose and pale below, thinly pubescent and yellowish-green to olive-green above, entire, sinuate, or crenulate-serrulate, acute to acuminate, rounded, subtruncate, or very shortly cuneate at the base, petioles 0.5–5 cm. long, puberulent and gummy; heads 7–9 mm. long, 5–7 mm. broad, on shortly villous pedicel-like peduncles 0.5–2.5 cm. long, arranged in leafy corymbose inflorescences 2–5 cm. long, at the ends of the branchlets and exceeded by the leaves, the short rhachis simple or sometimes forked near the base; involucres campanulate, 0.5–0.6 cm. high, phyllaries lanceolate or oblong-lanceolate, acute, pubescent; pales 4–5 mm. long, trifid, the lobes triangular, acute; rays none; disk-flowers 9 to 15, corolla 5 mm. long, the outside puberulent; anthers nearly entirely exserted, the appendage rather narrow, 0.5 mm. long; achene oblong, 3–4 mm. long; pappus-bristles 1 mm. long or pappus and pappus-rudiments obsolete.

References. Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911), Trans. Wisc. Acad., **18**: 283 (1915).

Collections studied, all from Albemarle Island: Tagus Cove, *Snodgrass and Heller No. 910* (type, G); Tagus Cove Mt., 2500 ft., *Snodgrass and Heller No. 254* (DS, G); Tagus Cove Mt., 4000 ft., *Snodgrass and Heller No. 875* (DS, G); Tagus Cove Mt. above 1200 ft., *Stewart No. 678* (CAS, G, K); summit of Tagus Cove Mt., 4000 ft., *Howell No. 9562* (CAS); Cowley Bay Mt., *Stewart No. 679* (CAS, G).

The last collection cited above may prove to be a distinct variety when adequate material is obtained. In Stewart's specimens, the leaves are more resinous-glandular, the pubescence is thinner and

harsher, and the leaf-margins are more prominently serrulate than in the specimens from Tagus Cove. The achenes are devoid of pappus but since some achenes in specimens from above Tagus Cove have been seen which have no pappus, this is scarcely to be counted a diagnostic difference. It is of interest to note that in character of pubescence the Cowley Bay plants are about intermediate between the plants of Tagus Cove and *S. cordata* Stew., which comes from still further south on Albemarle Island, a character difference which seems to be correlated with distribution, and which indicates yet again how closely *S. cordata* is related to *S. microcephala.*

On the south side of Narborough Island at 2000 ft., Snodgrass and Heller (*No. 343*, DS, G) collected sterile specimens of a *Scalesia* of this relationship and they are tentatively referred here until flowering or fruiting specimens are obtained.

8. **Scalesia cordata** Stewart

Proc. Calif. Acad. Sci., (4), **1**: 156, pl. 4, fig. 4, 5, 6 (1911)

Trees up to about "9 m." tall; branches tomentulous-puberulent and resinous-glandular at first, early becoming glabrate; leaves ovate, broadly cordate at base, the basal lobes rounded, acute to subacuminate at the apex, 8–17 cm. long, 5–11 cm. wide, paler and finely puberulent to thinly tomentulous below, olivescent and sparsely scabrid-pubescent above, margin more or less crenulate-undulate, petioles 3.5–7 cm. long, thinly puberulent; inflorescence and heads similar to those of *S. microcephala* Rob.; flowers unknown; achene oblong, 3–3.5 mm. long, with two well-developed pappus-bristles 1–2 mm. long.

References. Stew., Proc. Calif. Acad. Sci., (4), **1**: 209 (1911), Trans. Wisc. Acad., **18**: 285, 290 (1915).

Scalesia n. sp. ?, Rob., Proc. Amer. Acad., **38**: 220 (1902).

Collections studied, all from Albemarle Island: above Villamil, *Stewart No. 669* (CAS, type; G, K); Iguana Cove at 1000 ft. or less, *Snodgrass and Heller No. 856* (G); Iguana Cove, 1000 to 2000 ft., *Snodgrass and Heller No. 869* (DS, G).

Adequate flowering and fruiting specimens of *S. cordata* have not yet been collected. The fragmentary and partially broken heads of Stewart's collection show that it is very near *S. microcephala* Rob., and when it is better understood it will probably be interpreted as a variety of that species. The distinctive leaf-base appears to be the only real difference between the two entities, although from Stewart's account *S. cordata* would appear to be definitely more arboreous than *S. microcephala.* In citing his specimen, Stewart writes, "Villamil, occasional trees at 175 ft., abundant at 250–600 ft., smaller and less abundant at 1300 ft." (1911, p. 157). On the Templeton Crocker Expedition of the California Academy of Sciences I collected on Villamil Mt. on an overnight excursion to Santo Tomás, but this remarkable tree was not seen; and at Iguana Cove

where a brief stop was also made, time ashore was not sufficient to get much beyond the flat where I landed.

Series 3. **Foliaceæ**, ser. nov.

Frutices, ramulis foliisque pilis sericeis pilosis glanduloso-scabrisve vestitis; foliis anguste ad late lanceolatis, trinervatis ex basi, integris, petiolis exalatis; capitulis homogamis et discoideis; phyllariis exterioribus foliaceis et disco conspicue longioribus.—Species typica, *S. atractyloides* Arn.

Shrubs, the branchlets and leaves sericeous, pilose, or glandular-scabrous; leaves narrowly to broadly lanceolate, 3-nerved from base, entire, petioles unwinged; heads homogamous and discoid; outer phyllaries foliaceous and conspicuously exceeding the disk.—The type sepcies, *S. atractyloides* Arn.

KEY TO THE SPECIES

a. Leaves linear-lanceolate, cinereous, not scabrous except on margins, not noticeably glandular; involucres becoming strongly constricted above the swollen indurate base; lobes and sides of the pales not lacerate.

b. Pubescence sericeous and appressed; heads about 1 cm. high, on slender peduncles up to 1.5 cm. long; corollas 6.5 mm. long; achenes without pappus-bristles or rudiments... .....9. *S. atractyloides*

bb. Pubescence pilose, the outer parts of the leaf-blades with shorter subappressed hairs; heads about 1.5 cm. high, nearly sessile; corollas 8–9 mm. long; achenes with short pappus-bristles or with variously shortened or obsolescent rudiments.....10. *S. Darwinii*

aa. Leaves lanceolate to ovate-lanceolate, olivaceous, very scabrous, conspicuously glandular; involucres not constricted, the base not so indurate; lobes and sides of the pales lacerate-serrulate.....11. *S. Stewartii*

9. **Scalesia atractyloides** Arnott

Lindley, Nat. Syst. Bot., 443 (1836)

Shrub 1.5–2.3 m. high, the foliage and young stems cinereous with a short, appressed, nonglandular pubescence, sericeous on the young parts, somewhat harsher on old leaves; leaves loosely clustered at the ends of elongate, naked branches, linear-lanceolate, to 10 cm. long, 6–8 mm. wide, caudate-attenuate, narrowing at base into a petiole 0.5–1 cm. long, margin entire or somewhat undulate, in age scabrous and more or less revolute, the lateral veins and midrib evident below, the lateral veins confluent with submarginal veins; heads one or several at the ends of branches, almost hidden among the leaves, rather loosely flowered, about 1 cm. long, the peduncles slender, to 1.5 cm. long; phyllaries lanceolate, at base becoming indurate-thickened and the involucre more or less constricted near the middle in age, one or more of the outer phyllaries exceeding the head, elongate, foliaceous and up to 2 cm. long; pales 8 mm. long, strongly carinate along the prominent midrib, the lobes subulate-triangular, equal in width, 2–2.5 mm. long; rays none; flowers about 20, the corolla 6.5 mm. long, gradually widening upward, the lower part hairy, the upper part subglabrous or hairy on veins below sinuses and on lower sides of lobes, lobes spreading-recurved; anthers nearly entirely exserted, the appen-

dage about 0.6 mm. long, triangular-lanceolate; style-branches coiled, a little more than 1 mm. long, the tip thickened, hairy, triangular-pointed; achenes a little more than 3 mm. long, mottled, without pappus-bristles or rudiments.

References. DC., Prod., **7**: 308 (1839); Hook. and Arn., in Hook., Jour. Bot., **3**: 312 (1841); Walp., Repert. **2**: 611 (1843); Hook. f., Trans. Linn. Soc., **20**: 210 (1847); Ands., Kgl. Vet. Akad. Handl., 1853: 90, 179 (1855); Ands., Bot. Eugenies Resa, 17 (1857), 69 (1861); Rob., Proc. Amer. Acad., **38**; 216 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156, 207 (1911), Trans. Wisc. Acad., **18**: 331 (1915); Riley, Kew Bull., 1925: 223.

Collections studied. Galapagos Islands, *Cuming No. 106 in 1831*[4] (type, K); James Bay, 3 miles inland, *Cheesman on St. George Expedition No. 387* (K); James Bay, *Stewart No. 666* (CAS, G, K).

Although *S. atractyloides* was the first species of *Scalesia* to be known, it is one of the rarest and is one of the most local in distribution. It is found "among lava rocks" (Riley), and "on borders of recent lava flows where it grows to the exclusion of all other large vegetation" (Stewart) at lower elevations on James Island in the vicinity of James Bay. *Scalesia Darwinii* Hook. f., *S. Stewartii* Riley, and *S. atractyloides*, all of which are endemic on James Island, form a remarkably compact series in *Scalesia* characterized by the foliaceous outer phyllaries and the entire, lanceolate or linear-lanceolate leaves.

10. Scalesia Darwinii Hook. f.

Trans. Linn. Soc. **20**: 211 (1847)

Arborescent shrub 2.6–3.3 m. tall, pale and cinereous, the upper stems, bases of leaves, petioles, and involucres with long, soft, pilose hairs, the outer part of the leaf-blade with shorter, subappressed hairs; leaves clustered at the ends of branches, narrowly lanceolate to linear-lanceolate, to 10 cm. long, 0.6–1.3 cm. wide, gradually narrowing from below the middle into a long attenuate tip, gradually or more abruptly cuneate at the base, margin entire or broadly undulate, venation evident below, the lateral veins confluent in a submarginal vein, petiole 1–1.5 cm. long; heads solitary at the ends of branches, almost sessile among the leaves and nearly concealed, constricted near the middle, the base becoming swollen and indurate in age, 1.5 cm. long without the foliaceous elongate phyllaries which are up to 2.5 cm. long and linear-lanceolate or lanceolate-attenuate; pales 8 mm. long, the lobes triangular and about equal in width, ciliate, the lateral lobes 1 mm. long, middle lobe 2 mm. long; rays none; flowers crowded, more than 20, corolla 8–9 mm. long, the tube hairy from near the base to above the middle, subglabrous above or sparsely hairy on veins or on the lower sides of the spreading-recurved lobes; anthers almost entirely exserted, the appendage triangular-lanceolate, 0.6–0.7 mm. long; style-branches about 1.5 mm. long; achene 4 mm. long, mottled light and dark brown; rudimentary pappus present or obsolete, or pappus of 1 or 2 bristles 1 mm. long.

References. Walp., Ann. Bot. **1**: 414 (1848-9); Ands., Kgl. Vet. Akad. Handl., 1853: 90, 179 (1855); Ands., Bot. Eugenies Resa, 17 (1857), 70 (1861); Rob. and Greenm., Amer. Jour. Sci., (3), **50**: 146 (1895), in part; Hemsl., in Hook. Icon., pl. 2719 (1901); Rob., Proc. Amer. Acad., **38**: 216 (1902), in part; Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911).

[4] It seems likely that the date of Cuming's visit to the Galapagos Islands was in 1829. James Island was one of the islands visited by Cuming.

Collections studied, both from James Island: James Island, *Darwin* (type, Cantab.); James Bay, around 1000 ft., *Stewart No. 670* (CAS, G, K).

Scalesia Darwinii, another rarely collected species, is closely related to *S. atractyloides* Arn., but the differences between the two do not seem to be the kind that will disappear or intergrade when more extensive collections are obtained. Both species are found on James Island adjacent to James Bay, but from Stewart's notes there would appear to be a distinct break in the distribution of the two, *S. atractyloides* being found at lower elevations, *S. Darwinii* being found "around 1000 ft." As Stewart has pointed out (1911, p. 157), Darwin probably confused *S. pedunculata* Hook. f. and *S. Darwinii* when he described the latter as "forming woods of straight trees in the alpine or damp region" (Trans. Linn. Soc. **20**: 211).

The soft, pilose hairs of *S. Darwinii* are denser and much longer on the petioles, the upper branches, and about the heads than are indicated in the drawing in Hooker's Icones, pl. 2719; and the pubescence on the leaf-blades is not uniformly distributed from base to tip as is shown there, but rather the numerous long hairs near the base of the blade pass into the shorter and more appressed hairs, especially on the upper side.

11. **Scalesia Stewartii** Riley
Kew Bull. 1925: 223

Arborescent shrub with single trunk and generally with branches and leaves forming a narrow crown, 0.7–3 m. tall, the young stems with stipitate glands and long slender pilose hairs; leaves dark green or olivaceous, lanceolate to ovate-lanceolate, 5–11 cm. long, 0.7–2 cm. wide, acuminate, broadly or narrowly cuneate at base, entire, very scabrous and stipitate-glandular on both sides, the base of the leaves and the petioles sparsely set with long, slender, brittle white trichomes, the petioles 0.3–1. 5 cm. long, the venation evident below, the lateral veins confluent with a submarginal vein; heads solitary among the leaves at the ends of branches on short peduncles up to 1.5 cm. long, the head tubular-campanulate, not constricted above the base, the outer phyllaries up to 3.5 cm. long, broad and spreading with an expanded foliaceous limb, texture and pubescence as in the leaves; pales 9 mm. long, the lobes triangular-acuminate, serrulate-lacerate, equal in width, the lateral lobes 2 mm. long, the middle lobe 3 mm. long; rays none; corollas 40 or more, 7–8 mm. long, glabrous below, hairy about the middle, above subglabrous or hairy on nerves and on the lower sides of the spreading lobes; anthers completely exserted, the appendage lanceolate-ovate, 0.5–1 mm. long; style-branches 2 mm. long, short-hairy at the thickened, triangular cuspidate tips; achenes 3–4 mm. long, compressed, light brown with darker mottling; pappus none.

References. *S. atractyloides* Stew., not Arn., in part, Proc. Calif. Acad. Sci., (4), **1**: 156 (1911), Trans. Wisc. Acad., **18**: 328 (1915).

Collections studied, both from James Island: northwestern side on lava beds near the coast and above 700 ft., *Stewart No. 667* (K, type; CAS, G); Sulivan Bay, on lava-flow where little else grows, *Howell No. 10020* (CAS).

Stewart's *Scalesia* is very distinct from its immediate relatives, *S. atractyloides* Arn. and *S. Darwinii* Hook. f., notably in the scabrous and glandular trichomes on the broader leaves, the unconstricted involucre, and the conspicuously expanded, foliaceous tips of the outer phyllaries. It seems eminently fitting that this remarkable species is dedicated to Dr. Alban Stewart to whom goes the distinction of obtaining the most adequate and complete collection of specimens in this genus yet to be prepared.

Series 4. **Lobatæ**, ser. nov.

Frutices, ramulis foliisque plus minusve villosis glandulosisque scabris vel raro subglabris; foliis variabilibus, profunde et irregulariter serratis ad bi- vel tri-pinnatifidis, venis lateralibus divaricatis et terminantibus in dente vel lobo marginali, petiolis exalatis; capitulis discoideis, floribus similibus fertilibusque vel interdum extremis sterilibus corollis radiato-dilatatis et plus minusve obliquis; phyllariis exterioribus et disco subæqualibus vel phyllariis paullum brevioribus.—Species typica, *S. incisa* Hook. f.

Shrubs, the leaves and branchlets more or less villous and glandular, scabrous or rarely subglabrous; leaves variable in shape, deeply and irregularly serrate to bi- or tri-pinnatifid, the lateral veins divaricate and ending in a marginal tooth or lobe, petioles unwinged; heads discoid, the flowers all alike and fertile, or sometimes the outermost sterile and with corollas radiate-enlarged and more or less oblique; outer phyllaries about equalling the disk or a little shorter.—The type species, *S. incisa* Hook. f.

Key to the Species

a. Leaves alternate or occasionally the upper nodes approximate and the leaves opposite or subopposite, the blades grossly serrate to prominently lobed, the primary sinuses rarely extending more than ⅔ of the way to the midrib.

b. Vesture of upper stems, leaves, and peduncles scabrous, scarcely villous or glandular, the trichomes not drawn out in an elongate hair-like process; lobes and sides of pales entire.

c. Leaves grossly serrate, the serratures entire or serrate; peduncles equalling or longer than the leaves, 6–8 cm. long; phyllaries oblong to ovate, 4–5 mm. broad ..... 12. *S. divisa*

cc. Leaves lobed, the lobes irregularly few-toothed; peduncles equalling the petioles, 2–3 cm. long; phyllaries linear-oblong, 1.5–2 mm. broad ..... 13. *S. incisa*

bb. Vesture of upper stems, leaves, and peduncles slightly to markedly viscidulous or glandular, villous or pilose, the base of the trichomes sometimes scabrous-hardened, the pubescence sometimes scant; lobes and sides of pales finely serrulate to laciniate.

d. Pales with lobes similar, triangular and sharply acute to acuminate; heads 1.5–2 cm. across, the corollas straight and bearing coarse trichomes on the lower side of the lobes ..... 14. *S. retroflexa*

dd. Pales with lobes unequal in width, or, if nearly equal, then the lobes obtuse or oblanceolate; heads about 1 cm. across, the corollas strongly outwardly curving, devoid of coarse trichomes on the lobes (the lobes ciliate in *S. Hopkinsii*).

e. Pales with lobes oblong to triangular-oblong, widest at or below the middle; peduncles 1.5–3.5 cm. long.15. *S. Baurii*

ee. Pales with lobes oblanceolate to oblong-obovate, widest above the middle; peduncles 2–8 cm. long.

f. Shrub 2–3 m. tall, the herbage pilose, the young parts subsericeous, or the pubescence inconspicuous with hairs fewer and shorter; lobes and teeth of the leaves mostly sharply acute.....16. *S. Hopkinsii*

ff. Low shrub to 1 m. tall, the herbage subglabrous; lobes and teeth of leaves mostly rounded and obtuse .....17. *S. Snodgrassii*

aa. Leaves opposite, the blades finely dissected and twice or thrice pinnatifid, the primary sinuses extending nearly to the midrib.18. *S. Helleri*

12. **Scalesia divisa** Ands.
Kgl. Vet. Akad. Handl. 1853: 179 (1855)

Shrub 1–2 m. tall, the upper part of the stems somewhat glandular and scabrous; leaves alternate, pubescent when young, becoming scabrous, scarcely glandular, ovate, 4–8 cm. long, 2–4 cm. wide, rounded or broadly cuneate at base, the margin irregularly and coarsely serrate-lobed or serrate, the serratures entire or irregularly serrate, the petiole slender, 1–4 cm. long; heads discoid, many-flowered, 1.5–2 cm. broad, peduncles glandular and scabrous under the head, 6–8 cm. long, equalling or exceeding the leaves; phyllaries in 2 or 3 series, oblong-lanceolate to oblong-oblanceolate or narrowly ovate, about 1 cm. long, mostly 4–5 mm. wide, scabrous outside; pales 7 mm. long, the lobes about a third as long, triangular, acute, ciliate; corollas about 4 mm. long, those on the periphery curved outward in mature heads, the lobes ciliate, the upper part of the tube glabrous, the lower part hairy; anthers becoming entirely exserted, the apical appendage about 0.5 mm. long, oblong-ovate; achene 4 mm. long, with or without rudiments of 2 pappus-paleæ.

References. Ands., Kgl. Vet. Akad. Handl., 1853: 69, 72, 89 (1855); Walp., Ann. Bot., **5**: 219 (1858); Ands., Bot. Eugenies Resa, 7, 8, 16, tafl. 7, fig. 1 (1857), 70 (1861); Rob., Proc. Amer. Acad., **38**: 217 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad. **18**: 305 (1915).

Scalesia divisa is known from only two collections, the original made by Andersson in 1852 on Chatham Island, and reported as frequent in rocky places in the lower parts (Holm., type; CAS, G, K), and the second by Stewart, *No. 672* (CAS, G), collected on Chatham Island at Sapho Cove from lava beds near the coast. The species is closely related to *S. incisa* Hook. f., also from Chatham Island, but Hooker's species differs in its lobed leaves, shorter peduncles, smaller heads with fewer flowers, and linear-oblong phyllaries. The corollas in the only known specimen of *S. incisa* are straight, but in *S. divisa* the corollas are outward-curving in mature heads. *Scalesia divisa* perhaps finds even a closer relation in *S. aspera* Ands., as

has been indicated in the discussion under *S. aspera*. A primitive antecedent of these species might have been the first form to diverge from that complex of which the radiate species in the series *Dentatæ* are believed to be modern representatives; and from such a form not only have *S. aspera* and *S. divisa* probably been derived, but also the series *Lobatæ*.

13. **Scalesia incisa** Hook. f.
Trans. Linn. Soc. **20**: 210 (1847)

Shrub (?) with stems and leaves more or less scabrous, almost devoid of pilose hairs and rarely glandular; leaves alternate, plane, narrowly ovate, about 5 cm. long and 2.5 cm. wide, scabrous and with very few glandular hairs, irregularly pinnately lobed, the sinuses extending about half way to the midrib, the lobes approximate and irregularly few-toothed, the petiole slender, 2–3 cm. long; head discoid, many-flowered, about 1 cm. broad, peduncle about equalling the petioles; phyllaries in 2 series, linear-oblong, acute or subobtuse, 1.5–2 mm. broad, 8 mm. long, equalling the pales; lobes of the pales triangular, shortly acute and beset with peculiar thickish, conical trichomes; corollas straight, pubescent below the middle and very slightly upward along the veins, the outside of the lobes with a few conical trichomes; achenes 4 mm. long, oblong, with minute rudiments of 2 pappus-paleæ.

References. Walp., Ann. Bot., **1**: 414 (1848-9); Ands., Kgl. Vet. Akad. Handl., 1853: 72, 89, 179 (1855); Ands., Bot. Eugenies Resa, 16 (1857), 70 (1861); Hemsl., in Hook. Icon., pl. 2716 (1901); Rob., Proc. Amer. Acad., **38**: 217, 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911).

Scalesia incisa is known only from a single collection, that of Darwin on Chatham Island in 1835 (Cantab.). The leaves are more like those of *S. Baurii* Rob. and Greenm. in shape, but the pubescence is entirely different, and the two species can be readily separated by the shape of the phyllaries. According to Hemsley, *S. retroflexa* Hemsl. is most closely related to *S. incisa*, but the two species can be separated by vesture, leaves, and phyllaries, and may not be so nearly related as stated. It would appear that *S. incisa* has its closest affinity in *S. divisa* Ands., which also grows on Chatham Island. For a time it was thought that *S. incisa* and *S. divisa* might be varieties of a single species, but *S. divisa* is adequately distinct in its serrate leaves, larger heads, broader phyllaries, and different pales.

A comparison of the plate of *S. incisa* (Hook. Icon. pl. 2716) with the type of the species discloses several details in the plate which are not as accurate as might be desired for critical study. In the type the leaves are more irregularly lobed and toothed, the phyllaries are linear-oblong and acute or subobtuse, and, perhaps most critical of all, the lobes of the pales are triangular and shortly but definitely acute. The examination of the type and discovery of the acute lobes of the pales brought *S. incisa* into even closer relationship with *S. divisa* than with *S. Baurii*, where its affinity would be sought if emphasis were placed on the character of the

pales as illustrated. In the detail of the flower and achene in the plate, there is no indication of the stubby rudiments of pappus which were discovered in examining the type; but the neglect of this minute detail in the drawing is rather to be expected, since, before this, attention has not been directed to this character in any species in this section of the genus.

14. **Scalesia retroflexa** Hemsl.
Hook. Icon. pl. 2715 (1901)

Shrub about 2 m. tall with villous hairs on stems, leaves, and peduncle, these parts also with numerous glandular hairs; leaves alternate, noticeably retroflexed, ovate to oblong, cordate at base, 6–10 cm. long including the slender petiole, pinnately lobed, the lobes finely and regularly toothed or cleft, margins crisped; heads discoid, solitary on short peduncles in the axils of the upper leaves, many-flowered, about 1.5–2 cm. broad; phyllaries ovate to ovate-lanceolate, acute or obtuse, equalling the pales; lobes of the pales triangular, acute or acuminate, the margins of the lobes serrate-ciliate with stout, spreading trichomes; corolla puberulent outside; achene without even rudimentary pappus.

References. Rob., Proc. Amer. Acad., **38**: 217, 219 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158 (1911).

Scalesia retroflexa is known only from the type specimen which was collected on Indefatigable Island by Habel in 1868 (K). It consists of a single branch, which is beautifully delineated in the plate accompanying the original description.

15. **Scalesia Baurii** Rob. and Greenm.
Amer. Jour. Sci., (3), **50**: 141 (1895)

Shrub, stems and petioles with villous hairs from more or less thickened conical bases, which on the older parts becomes hardened and scabrous, the branchlets and petioles also glandular; leaves alternate, or approximate below the heads, ovate, 3–10 cm. long, 2.5–7 cm. wide, cuneate at base, acute at apex, pinnately parted, the primary sinuses extending half way to the midrib or a little beyond, the lobes irregularly lobed and sharply serrate, the lobes and lobules generally acute, the blade finely scabrous above with a few elongate hairs, below pilose-scabrous with elongate tips on the trichomes, villous-hairy along the nerves, petiole about 3 cm. long; head discoid, 1 cm. long and about as broad, peduncles 1.5 to more than 3.5 cm. long, shorter than or equalling the leaves, scabrous under the head and subglabrous below or glandular and villous; involucre 5–6 mm. high, the phyllaries in 3 series, cinereous with short, scabrous trichomes, broadly elliptic-ovate to obovate, acute and tipped with a short mucro; pales 5–6 mm. long, the outer variously cleft and irregularly lobed, the inner trifid, lobes about 2 mm. long, acute, oblong-triangular, somewhat laciniate, the two outer lobes nearly twice as broad as the middle lobe; the corollas of the outer flowers enlarged, obliquely and palmately expanded, the tube outwardly curved, the whole simulating a ray and 6–7 mm. long, these flowers with abortive

stamens and pistil, the other corollas 5 mm. long, more or less outwardly curved, the tube hairy, the upper half and lobes glabrous; anther-appendage about 0.75 mm. long; style-branches 1.5 mm. long, the tips acuminate-acute, the branches spreading from about the middle; achene with 2 callosities indicating pappus-rudiments.

References. Rob. and Greenm., Amer. Jour. Sci., (3), **50**: 146 (1895); Rob., Proc. Amer. Acad., **38**: 216, 219, 247 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156 (1911), Trans. Wisc. Acad. **18**: 311 (1915).

The above diagnosis has been drawn chiefly from the type specimen, which was collected by Baur on Duncan Island, *No. 129* (G). The only other collection which has been seen which may be referred to this species is a collection also from Duncan Island, *Stewart No. 668* (CAS, G, K). From the type it differs in the following critical and important details: heads discoid, the outer corollas curving outward, the limb oblique, but not at all enlarged; the pales oblongish and about equally wide, the lateral lobes somewhat asymmetric and denticulate-fimbriate at the obliquely subtruncate tip, the middle lobe symmetrical and abruptly acutish. This collection seems to approach *S. retroflexa* Hemsl. but differs in the smaller leaves, less glandular pubescence, shorter involucre, the blunter lobes of the pales, and the more curving corollas.

The specimen called by Robinson *S. Baurii* var. *glabrata* (Duncan Island, *Snodgrass and Heller No. 706*, G) would seem to be nearer *S. Snodgrassii* Rob., and it is referred to that species in this work. This opinion can scarcely be regarded as decisive, since paucity of material and lack of sufficient collections preclude a really adequate treatment.

16. **Scalesia Hopkinsii** Rob.

Proc. Amer. Acad. **38**: 217, pl. 3, fig. 1 (1902)

Shrub 2–3 m. tall, the stems, leaves, and peduncles pilose, the young parts subsericeous, some of the hairs viscidulous, or the pubescence scant; leaves alternate or subopposite, ovate, acute, shortly cuneate or truncate to broadly cordate, 6–10 cm. long, 4.5–8.5 cm. wide, irregularly pinnately lobed and serrate, the lobes and serrations usually sharp, occasionally obtuse, the primary sinuses shallow, or extending a little more than halfway to midrib, paler and more pubescent beneath, slightly scabrous in age, petiole 1–3 cm. long, pilose; heads 1–1.3 cm. long, about 1 cm. broad, flowers numerous; peduncles 2–6.5 cm. long, shorter than the leaves; involucre 5–7 mm. high, the phyllaries in about 3 series, oblong to obovate or suborbicular, obtuse or subacute, sometimes mucronulate, densely pilose on the outside and ciliate; pales 6–8 mm. long, the lobes oblong to broadly oblanceolate, generally obtusish or obcordate, the margin serrulate-ciliate; outermost corollas about 5.5 mm. long, the limb strongly recurved and folded, 3-toothed at tip or 4- or 5-lobed and obliquely bilabiate, inner corollas about 5 mm. long, the tube thick and hairy, the throat glabrous, the lobes ciliate and hairy on the lower side, or glabrous, the outer corollas spreading; style-branches 1–2 mm. long, divergent or recurved-coiling, the

tip somewhat enlarged, acute, hairy on lower side; achenes 3–4 mm. long, flattened or trigonous, callous with pappus-rudiments which sometimes carry a bristle 1 mm. long.

References. Rob., Proc. Amer. Acad., **38**: 219, 243 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad. **18**: 275 (1915).

As is the case in all species of the series *Lobatæ*, *S. Hopkinsii* is inadequately known from insufficient material. Only three collections, all from Abingdon Island, can be definitely placed: the type collection made by Snodgrass and Heller (*No. 851*, G, type, DS), and two collections made by Stewart (*No. 676* and *No. 677*, CAS, G, K). From Stewart's report on his collections, it can be inferred with reasonable certainty that *No. 677*, with smaller pinnatisect leaves, came from near the shore and that *No. 676*, with broader thinner leaves, came from above 330 m. (Proc. Calif. Acad. Sci., (4), **1**: 158). The variability shown by these two collections would indicate that variations in the species may prove to be of such a nature that lines between it and related species will disappear when further collections are made.

In Herb. Kew. there is a fragmentary collection made by Habel in 1868 on Indefatigable Island. When this was examined by the writer at Kew in 1935, it was noted as "seemingly near *S. Hopkinsii*. The leaves match Stewart's Abingdon plant in which the leaves are less cleft (*No. 676*) and the pubescence is similar." The place of collection of Habel's specimen may not be right. He collected on Abingdon Island as well as on Indefatigable Island and it may be suspected that the fragment in question originated, not on Indefatigable Island where *S. Hopkinsii* has not otherwise been collected, but rather on Abingdon Island, where Stewart reports it as "common bushes 6–8 ft. high from the vicinity of the shore to 1500 ft." (*op. cit.*, 157). There is a tracing of the Habel collection in Herb. Gray.

In the original description, *S. Hopkinsii* is described as "*capitulis eradiatis*." A careful examination of specimens of the type collection from both the Gray Herbarium and the Dudley Herbarium has disclosed no enlarged marginal corollas, which in Stewart's specimens are not conspicuous but which are evident and unmistakable on inspection.

17. **Scalesia Snodgrassii** Rob.

Proc. Amer. Acad. **38**: 219, pl. 3, fig. 8 (1902)

Shrub 0.6–1 m. tall, the stems subglabrous with very few scattered pilose and viscidulous hairs; leaves alternate, ovate, narrowly ovate or oblong-ovate, acute or obtuse, somewhat asymmetric and very shortly cuneate below the basal lobes, 5–10 cm. long, 3–6 cm. broad, irregularly pinnately lobed, the lobes again shallowly

lobed or grossly dentate, the lobes and teeth obtuse or subacute, the primary sinuses usually extending more than half way to the midrib, sparsely pilose-scabrous on both sides, the petiole 1.5–4.5 cm. long, sparsely pilose and viscidulous; heads 0.8–1 cm. long and about as broad, peduncles 5–8 cm. long, somewhat puberulent with long pilose and short glandular hairs, sometimes foliaceous-bracteate; involucres 5–6 mm. long, the phyllaries obovate-oblong, acute, pubescent and shortly ciliate; pales 5–7 mm. long, the outer asymmetrically lobed, the inner regularly lobed, the lobes tending to be oblong-obovate, acute to obtusish, serrulate-ciliate; outermost corollas strongly recurved, the limb 2–3 mm. long, shallowly or deeply 3-lobed, a small fourth lobe present on the inner side of the mouth of the throat; inner corollas 5 mm. long, the tube heavy and hairy, the throat light and glabrous, except along the nerves, the lobes glabrous, the corollas of the outer flowers strongly recurved; style-branches slender, acute, 2 mm. long, coiling; achene of outermost flowers trigonous, 3 mm. long, achene of inner flowers compressed, 3 mm. long, with 1 or 2 rudimentary pappus-bristles or the pappus reduced to obsolescent callosities.

References. Rob., Proc. Amer. Acad., **38**: 216, 251 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 158, 159 (1911), Trans. Wisc. Acad., **18**: 308, 338 (1915).

S. Baurii var. *glabrata* Rob., Proc. Amer. Acad., **38**: 216, 247 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 156 (1911).

Scalesia Snodgrassii was originally collected on Wenman Island by Snodgrass and Heller (*No. 10*, type, G; DS), and it was recollected there by Stewart (*No. 691;* CAS, G, K). *Scalesia Baurii* var. *glabrata* Rob., which is here referred to *S. Snodgrassii*, is known only from the type collection which was made on Duncan Island, *Snodgrass and Heller No. 706* (G, type; DS).

Scalesia Snodgrassii is very closely related to *S. Hopkinsii* Rob. and *S. Baurii* Rob. and Greenm., and with fuller knowledge derived from further collections it may be found necessary to treat them as subspecific entities of a single, polymorphic species. Because of the variability in characters of foliage and vesture by which the entities have been separated, there is at present insufficient material on which to base a proper specific concept, either for each one separately, or for a collective species. As pointed out by Robinson (*op. cit.*, 216), *S. Baurii* var. *glabrata* is "very near *S. Snodgrassii*," and we believe that it should be considered a part of the latter. The following notes taken from the type specimen of *S. Baurii* var. *glabrata* will serve to indicate the close resemblances and minor differences between *S. Snodgrassii* and it:

Uppermost stems thinly villous with long silky hairs, and with a few, short glandular hairs; leaves alternate, or appearing opposite below the peduncles, triangular-ovate, obtuse or subacute, truncate or subcordate, 3.5–4.5 cm. long, 3 mm. wide, pinnately lobed, the sinuses extending less than half the distance to the midrib, the lobes broad and rounded, shallowly lobed or toothed, subglabrous above and below, a few hairs and rigid trichomes on the midrib below, petiole 1 cm. long, with ascending, villous hairs and short, capitate glands; peduncle glandular-hairy, 4.5–7 cm. long, the heads exceeding the leaves; heads 1 cm. long and about as broad; involucres 6–8 mm. high, the phyllaries in about 3 series, broadly elliptic-ovate to obovate,

acute or the inner truncate or even subobcordate and abruptly acute, sparsely pubescent on the backs, finely and closely ciliate; outermost enlarged flowers 5 mm. long, 3-cleft at apex, the lateral lobes longer and broader than the middle, pubescent on the veins from end to end; inner corollas 4–4.5 mm. long, the tube hairy to about the middle, glabrous above, corollas mostly straight or the outermost slightly curved.

18. **Scalesia Helleri** Rob.

Proc. Amer. Acad. **38**: 217, pl. 1, fig. 9, 10 (1902)

Shrub, 2–2.7 m. tall, the upper stems, leaves, and peduncles conspicuously villous and more or less glandular-viscidulous, or the villous hairs inconspicuous and nearly lacking; leaves opposite, twice or thrice pinnatifid-dissected into linear or narrowly oblong segments, the sinuses between the primary divisions extending nearly to the midrib, glandular-scabrous, elliptical to ovate, 2–8 cm. long, 1.5–5 cm. broad, petioles 1–2 cm. long; heads 1–1.2 cm. long, 1–1.5 cm. broad, discoid, many-flowered, peduncles slender, about 2 cm. long, equalling or shorter than the leaves; involucre about 7 mm. long, phyllaries oblong, rounded above but usually shortly and very abruptly acute; pales about 6 mm. long, lobes 2 mm. long, triangular, acute or subacuminate, serrate-ciliate; corollas straight, about 5 mm. long, the lobes spreading slightly from their middle, the tube slender and narrow at base, glandular-encrusted and hairy below the lobes; anthers slightly exserted, the appendage 0.5–0.6 mm. long, triangular-ovate; style-branches divaricate, thick and clavellate, acute, 1 mm. long; achene oblong, 2–2.5 mm. long, without even rudimentary pappus.

References. Rob., Proc. Amer. Acad., **38**: 245 (1902); Stew., Proc. Calif. Acad. Sci., (4), **1**: 157 (1911), Trans. Wisc. Acad., **18**: 293 (1915); Christoph., Nyt Mag. for Naturvid., **70**: 95 (1932); Lemée, Dict. Gen. Pl. Phanérog., **5**: 997 (1934); Svenson, Amer. Jour. Bot., **22**: 213 (1935).

This very distinct species is known from only three collections, the first two from Barrington Island (*Snodgrass and Heller No. 466*, G, type, DS, and *Stewart No. 675*, CAS, G, K), and the third and most recent from Turtle Bay on the southern side of Indefatigable Island (*Rorud No. 155*). The last has not been examined by the writer, but in the other two collections there appears to be diversity in the vesture of the plants, the type collection being much more conspicuously pilose, the Stewart collection being more noticeably glandular.

The detailed drawing of a pale accompanying the original description (*op. cit.*, pl. 1, fig. 10) does not show the usual sort of lobing found in the pales. Usually the lobes are longer in proportion to the full length of the pale, and characteristically the lobes are sharply acute or even subacuminate. The drawing of the pale referred to is probably taken from one in the outermost series of the head, where occasionally they are not so deeply cleft or so acutely tipped.

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